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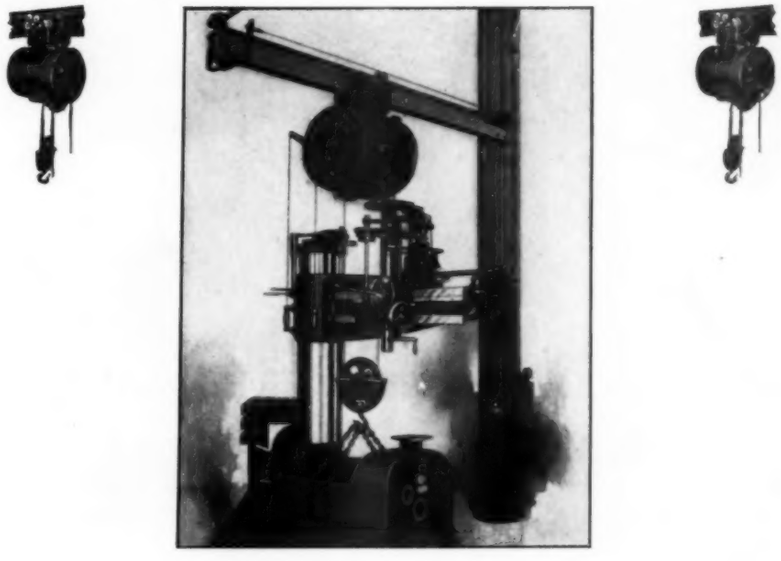

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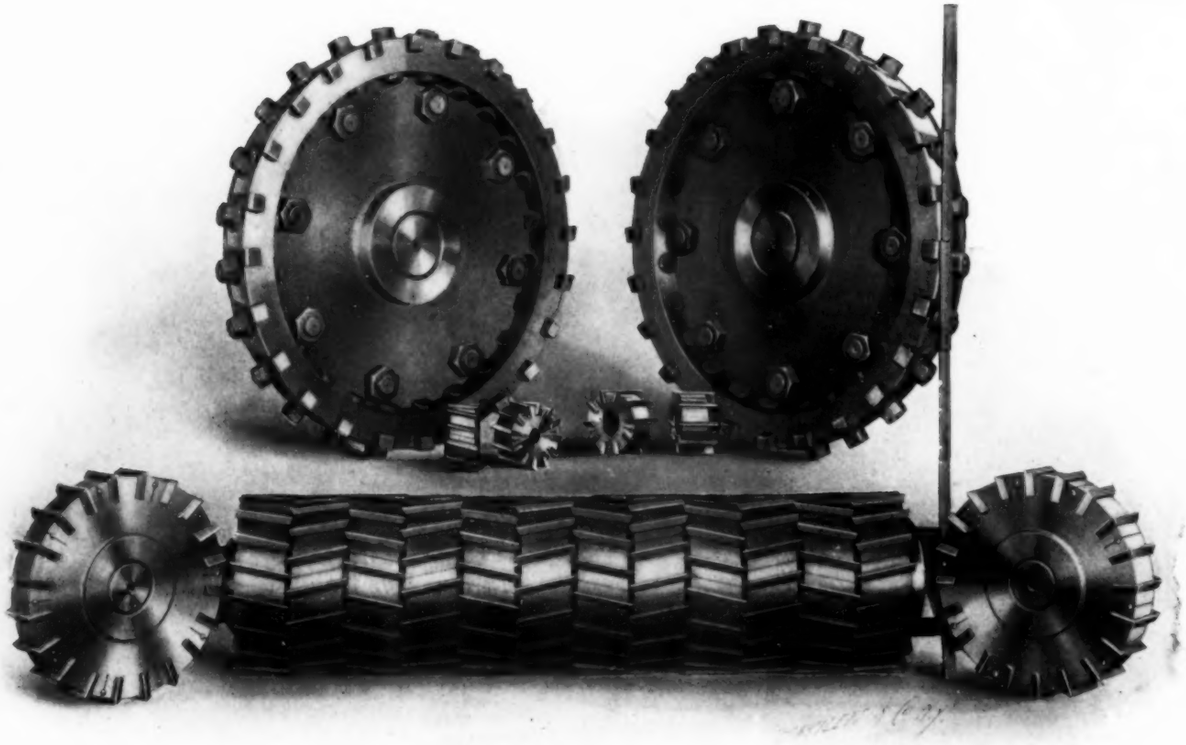

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(*See pages* 47 *and* 48)

Building the Alco Automobile

By Fred H. Colvin *

Fixtures which make the handling of work easy for the men; special machines for all work that warrants it and avoiding scraping of bearings.

A very simple and ingenious method of setting the timing gears and separately cast piston rings that are not turned or bored.

*Managing editor.

Many interesting machines and methods are used in building the Alco automobile, which is now enjoying the proud distinction of having won the Vanderbilt cup in two successive years. Some of these are shown in the accompanying illustrations, and all show careful attention to details in manufacturing.

A Crank-case Fixture

Figs. 1 and 2 show a boring fixture for the crank cases, which is used on a Lucas boring machine, and has several novel features. In order to make it easy for the operator, the fixture has a pair of slides or runways shown, on which castings are placed and can then be easily slid in position under the fixture, as shown in Fig. 2. After it has been slid into position, a movement of the lever operates the crank and links which swing the lifting fingers shown up against the under side of the engine base and raise it against the top or locating surface of the fixture. Then the crank handles screw the threaded studs on their lower ends into the tapped holes of the fixture and clamp it firmly against the two rails shown across the top. It is then bored in the regular way with boring bars carried by a double universal joint connection and, after being finished, is taken out by a reversal of these operations.

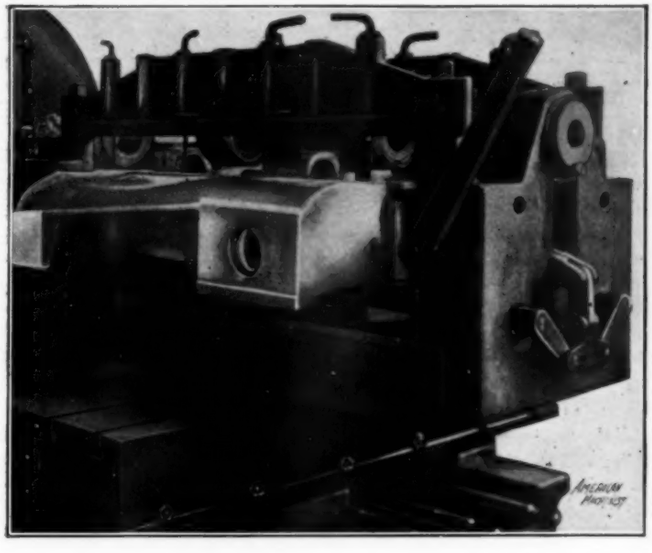


Fig. 1. Boring Fixture for Crank Case

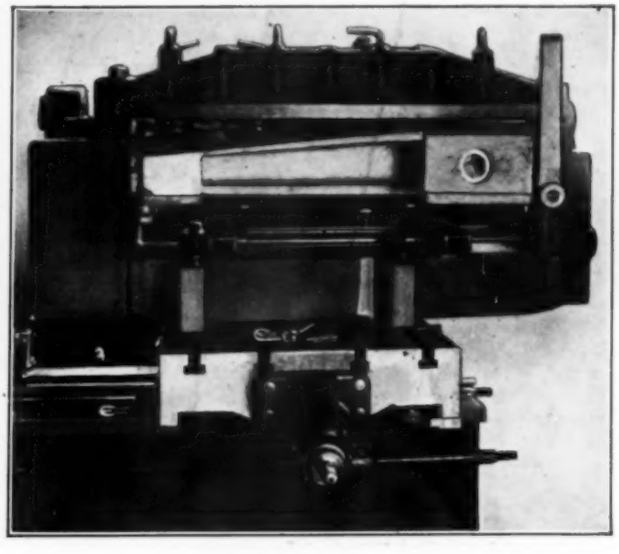


Fig. 2. Crank Case in Position

Hand-reaming Fixture for Crank Case

Fig. 3 shows the hand-reaming fixture for the crank cases, and shows the reamer in place for the final truing up of the main bearings of the crank shaft. In this case, the long reamer is run through these bearings one after the other, the portion behind the cutting edges filling the reamed hole and guiding the reamer on its way to the next bearing.

After this has reamed the last bearing, it remains in place and locates the position of the guiding castings at the end, while another reamer is finishing one of the other holes.

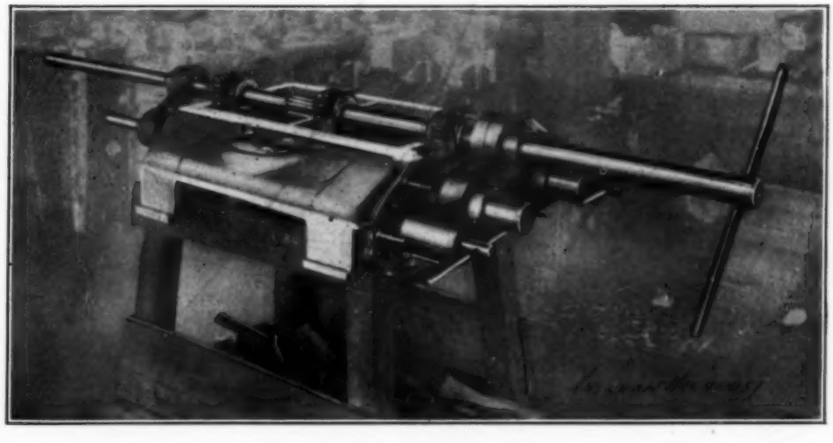


Fig. 3. Hand-reaming Fixture

Rear-axle Housing

The rear-axle housing for the Alco car is made from a single drop forging and is bored from each end by the special double-ended Newton boring machine, shown in Fig. 4. The housing is clamped on the central table shown, and the twisted drills shown in place, feed it from each end.

They are guided by the bushings shown, and are supplied with oil under

heavy pressure for washing out the chips. Each drill is driven independently by the motor shown at the back, and each has an independent controller in front. These motors are of 25 horsepower each, and the holes are drilled in 27 minutes, which includes both ends.

come through the housing and drive from the outside of the wheel. This is also an independently motor-driven machine, and handles these axles in remarkably short time. The drilling machine, Fig. 4, is shown at the extreme right of this illustration.

crank run through the two universal joints shown in Fig. 7. This is continued for two or three hours, and the bearings are "run in" in this way instead of being scraped as is usually done.

It has been found that a good bearing can be secured in this way much more quickly than by the scraping process, and the method has proved very satisfactory since its adoption.

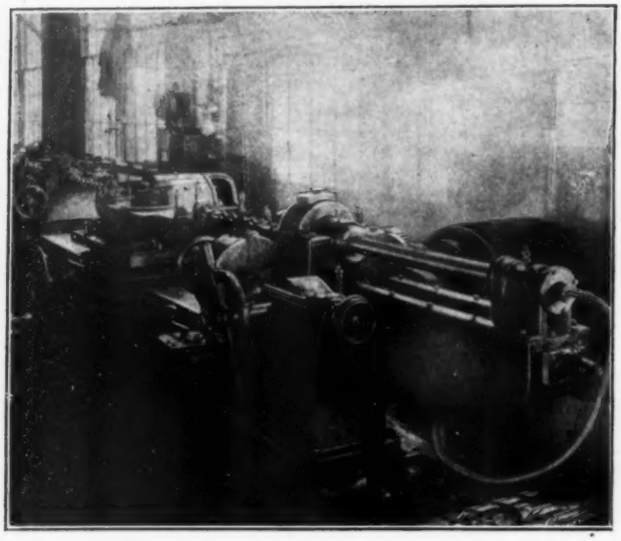


FIG. 4. DRILLING THE AXLE HOUSING

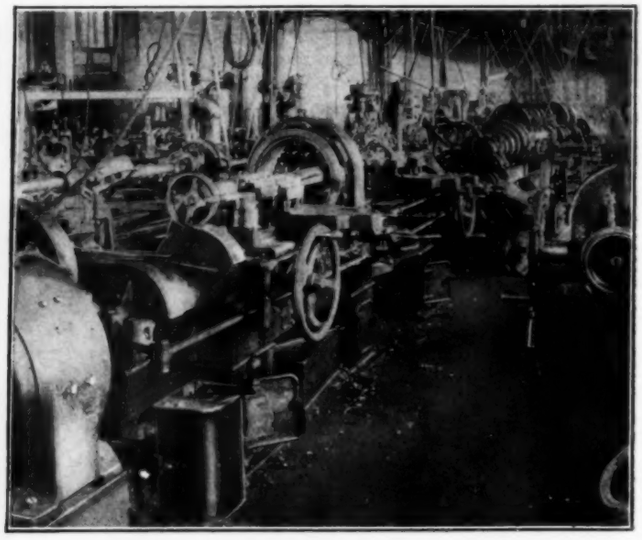


FIG. 5. SPECIAL AXLE-TURNING LATHE

Parallel with this, and so arranged that the work is easily transferred from one machine to the other, is the special turning lathe, shown in Fig. 5, built by the Tindel Morris Company. This is on the plan of a car-axle turning lathe, in which the work is driven at the center, so that both ends can be turned at the same time. These are turned to receive the wheel. This axle housing carries the wheel bearing at each end, the wheels being driven by floating half axles, which

MULTIPLE-SPINDLE DRILLING HEAD

Fig. 6 shows the special multiple-drilling head for drilling the holes in the engine crank case. This has 38 spindles, driven in two separate groups, and handles all the holes in this side of the crank case at one operation.

A suitable drilling jig is located on the base as a guide for the drills.

RUNNING IN THE CRANK-SHAFT BEARINGS

After the crank case has been hand reamed, as shown in Fig. 3, the crank shaft is put in place, the boxes bolted on, the bearings well lubricated, and the

DRILLING PISTON-PIN HOLES

Figs. 8 and 9 show how the hole for the piston pin is drilled in a high-power machine.

The body of this jig is made with feet, which raise it from the table so as to permit both the boring and reaming tools to pass through. The piston to be bored is inserted, as shown in Fig. 8, and is located by the inner end of the clamping bushing *A* bearing against the piston-pin lugs inside the piston. This makes it im-

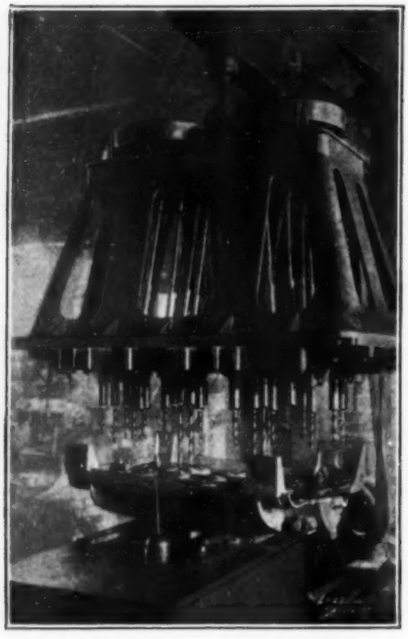


FIG. 6. MULTIPLE DRILLING HEAD

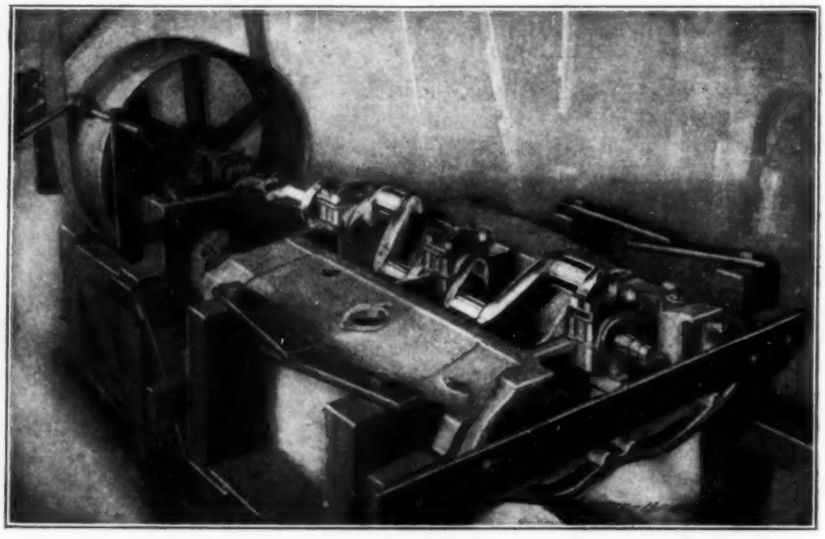


FIG. 7. RUNNING IN THE MAIN BEARINGS

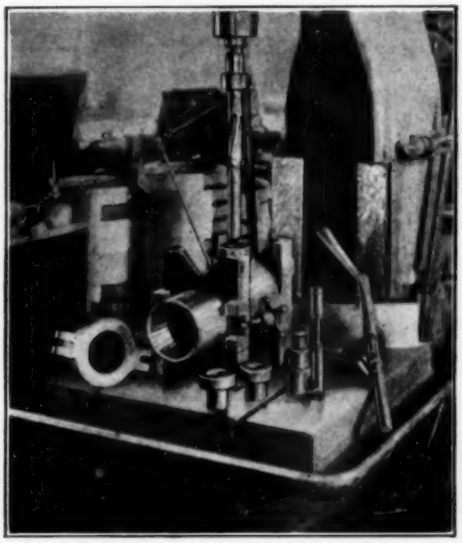


FIG. 8. PUTTING PISTON IN PLACE

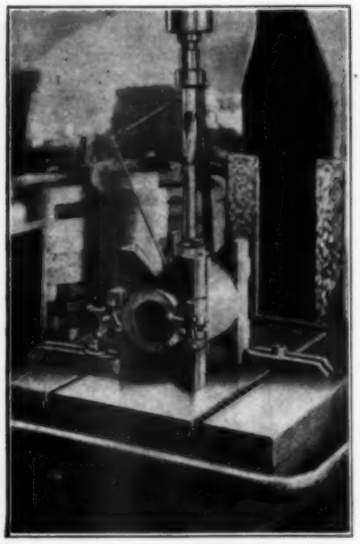


FIG. 9. READY TO DRILL

correctly located to operate the valves in the desired way, or at the proper time.

By simply stamping these gears, as can be seen in Fig. 11, it will readily be seen that in assembling the engine it is only necessary to turn the various shafts so that when the four gears are put in place, the corresponding numbers on the rim will be opposite each other. This can easily be done, putting on one gear at a time, and the engine is correctly timed without any of the usual setting by means of marks on the flywheel, or the use of other instruments. It is also equally simple for the user of one of these cars to replace any or all of these gears.

PISTON RINGS CAST SEPARATELY

The Alco piston ring is made in a different manner from that used by any other builder with whom we are familiar. Instead of being turned from a cylinder or pot, as it is usually called, each ring is cast separately and finished entirely by grinding. The reason is that in order to have the metal soft enough to turn readily inside and out, it is difficult to secure an iron which has a satisfactory spring, and which will not take a permanent set. These rings are extremely stiff and it is impossible to set them, as, while being extremely elastic, they break.

These rings are first rough ground on the sides, slipped over the mandrel shown

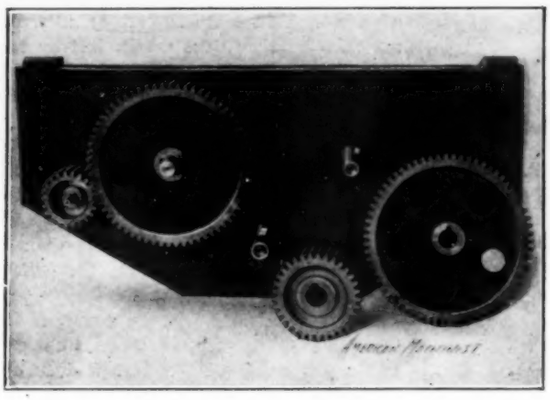


FIG. 10. FIXTURE FOR TIMING GEARS

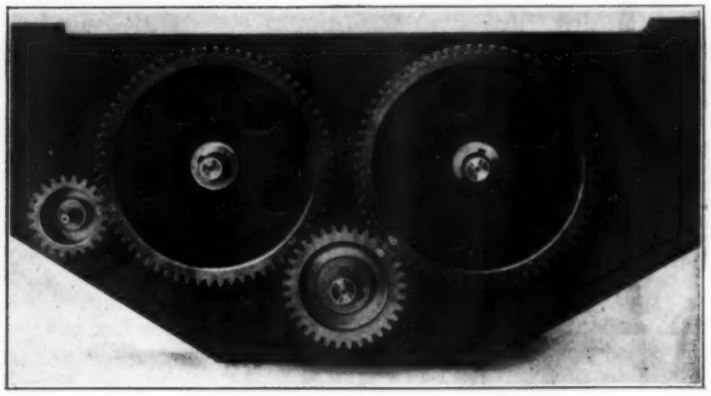


FIG. 11. GEARS IN PLACE PROPERLY MARKED

possible for the piston to be put in except in the correct position, the locating bushing being drawn down against the piston by the hand nut shown and forcing the end of a piston against a center, which locates it for distance and insures that the holes are all bored at a uniform distance from the end of the piston. The various bushings and the roughing and finishing reamers are shown, together with the three-lipped boring tool, shown in the spindle of the machine.

Fig. 9 shows the bushing in place, and the roughing reamer ready to be run through the piston.

FIXTURE FOR SETTING TIMING GEARS

Figs. 10 and 11 show the timing fixture, which makes the proper timing of the motor a very simple matter. This not only saves time in the shop, but also makes it possible for any user of an Alco car who breaks a gear to have a new one sent him, and to be able to put it in place without the aid of any special devices, or the need of any knowledge in regard to gas engines.

Every gear has its keyway cut with exact relation to the location of the teeth on the rim. This being done, it only becomes necessary to place the gears on the timing fixture shown and stamp corresponding numbers on teeth which come opposite each other where the gears mesh.

This timing fixture consists simply of a cast-iron plate, carrying four studs which represent the four shaft ends on the end of the engine crank case. These studs have their keys located in exactly the right position to correspond with the cams on the cam shaft, when they are

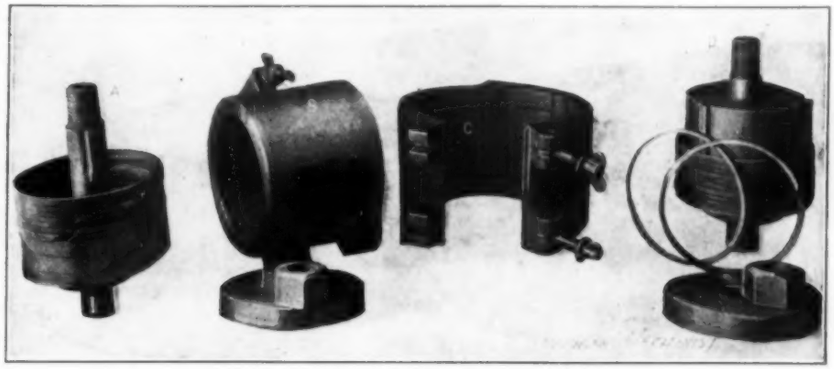


FIG. 12. FIXTURES FOR PISTON RINGS

at *D*, Fig. 12, the heavy side of the ring going to the left and the thin side over the pin shown at the right of the mandrel. They are then rough ground on the outside, and after this the finished grinding is done on the sides.

The next operation is to cut the rings on a hand milling machine in the regular way, and after this they are placed loosely over the mandrel *A* and brought together by being clamped in the fixture shown in *B* and *C*. This is opened and put around the rings, drawing them together and also centering them on the mandrel. They are then clamped firmly in position by tightening up the other flange, and are ready to be ground in the usual way on the outside. The inside of the ring is not machined in any way, and all other operations except cutting are performed by grinding on the machines regularly used in such work.

A Point for Mr. Taylor

By I. B. Rich

There is one point which you overlooked in the credit side of F. W. Taylor's ledger account—the fact that his agitation for efficiency stirred up more real thinking on the subject than we had ever done. I agree fully that he has made several fundamental mistakes, and that his system and systematizers are both open to grave criticisms, but let us give him credit for starting the ball rolling, no matter how much we differ from his ideas and methods.

While it would seem as though there must be a best speed and a best method for any kind of work, I recall two instances where this does not seem to be true or rather, where the variable quantities of both the materials and the men demand special treatment in each case.

They are both large shops on entirely different types of work. One followed Mr. Taylor's method of fixing the speeds and feeds, supplying the tools all ground to a standard shape and all seemed standardized as it should be. But the production dropped alarmingly in spite of the fact that the piece rate remained the same.

Thinking it was prejudice against innovations, the men were urged to get back to their old rate but only a few succeeded. Men do not intentionally cut their own pay for very long stretches, so after a three-months' trial, the old plan was put in force once more and production soon returned to its normal figure.

The variation in material was evidently met by the human element of the operator who varied speeds, feeds and tool to suit, so that his pay envelop might wax fatter at the end of the week. The cast-iron rule did not work out in this case.

Mr. Taylor would probably say that the material should have been uniform—but it is a very different matter to get it so from any steel mill that I know of. The "head looker," as referred to by R. E. Marks some time ago, does not seem to always look in exactly the same manner.

The other shop is on entirely different work, work using and requiring specialists, and securing the best production by allowing each man to handle speeds and feeds according to his own sweet will. Of course, it isn't scientific, according to some definitions, but it does seem to come under one of the twelve laws of efficiency according to Harrington Emerson—the law of common sense.

Whatever it may or may not be, it gets out more work than they have been able to do by fixing cast-iron rules for every movement of a man's eyebrows.

The most unfortunate thing about the advent of Taylorism is the antagonism it has aroused against all systems which are suggested from time to time. We can but admire the persistent energy with which he has kept the need of systematic management before the country. For this alone, if for nothing else, we owe him a debt of gratitude even though we may regret the unnecessarily antagonistic manner and the apparently fundamental errors which he advocates.

I do not believe that any system which assumes a monopoly of brains by any one man or any one department and which schedules every movement so that a man is simply one of the gears in the operation of the machine, will secure the best results in the long run. I believe it tends to eliminate initiative, to dull ambition and that a man who is made the mere puppet of a planning department will soon cease to think of much else beside "quitting time and pay day."

[He did not "start the ball rolling," though he has done a good deal to keep it rolling.—Ed.]

Grinding Notions That Lose Money

By John R. Godfrey

Habit is probably our most expensive accomplishment. We spend long hours learning how to do work a certain way and fixing it firmly in our minds as the only way. And when someone breaks away from the habit, either accidentally or with malice aforethought, we are very apt to try to show him the error of his ways instead of studying the real merits of the case.

End- or cup-wheel grinding is a case in point.

Ever since we began to make such work as collars or disks in the lathe, finishing with emery either on a stick or cloth, we became accustomed to seeing the lines run concentric with the outside of the disk or collar. Or perhaps we fondly imagined that there were no lines and that we had a dead smooth surface, unless we rubbed it across a surface plate or lap and found that it was a series of hills and valleys.

But when we grind thrust collars or disks, piston rings or similar work with a cup or ring wheel, all our habits of thought rebel at the lines which circle in various ways and rouse our criticism at regarding the "rough" finish that is left.

As a matter of fact, the apparent scratches are not nearly as deep as they look, being immeasurable in most cases, and lapping down to a dead smooth surface more easily than the surface finished in the good old way.

It is also true that in spite of the shock to our habits of thought, the wheel marks or apparent scratches do no harm whatever in most cases. They may even be a benefit in the case of thrust-bearing collars in helping to distribute the oil over the surfaces in contact.

Gas-engine men, who began grinding the sides of piston rings with the periphery of a wheel on a horizontal spindle, do not take kindly to the marks left by the cup wheel. But it is extremely doubtful if they would even know the difference in actual practice.

When we try to measure the depth of the alleged scratches or see how quickly a little lapping brings the surface practically dead smooth, it seems very evident that the surface left by a cup wheel is just as good as though the wheel marks were straight.

And we are surely losing money if we let habit alone turn us away from the cup-wheel work just because it does not match up with our previous notions.

If we can train ourselves to use the past simply as a guide instead of as a dictator of what is right or wrong, we shall form a habit that will win out in any line of work.

New Swedish Tariff

On the expiration of a number of commercial treaties between Sweden and other countries the new Swedish customs tariff will go into effect on December 1, 1911, and the text of the new law is now made public.

The whole system of the tariff has been changed from *ad valorem* to specific duties. Those interested can secure text of the new law from the treasury department at Washington.

In order that the many manufacturers in the State of Illinois may become familiar with the requirements of the recent law in regard to safety appliances and provisions which are made obligatory in the factories and work shops of that State, Edgar T. Davies, Security Building, Chicago, Ill., State factory inspector, has prepared a pamphlet explaining these requirements, which is for general distribution.

German Automatic Screw Machine

By D. Plodmann

This machine is driven with one belt, running from a patented countershaft to step pulley 1, which is mounted behind the spindle, the spindle being driven with gears and friction, giving right- and left-hand drive without any direct pull on spindle. Shaft 16 connected with pulley shaft by gears drives feed through gears 17 and 18, friction disks 19 and 20, roller 21, worm and worm wheel. For the quick feed, used when feeding up stock, etc., the cam drum is driven direct through gears 17, 18, 22 and 23 and worm and worm wheel. Gears 22 and 23 can be changed in cases where the quick feed has to be altered, whereby it is possible to give the same quick feed, irrespective of the spindle speed.

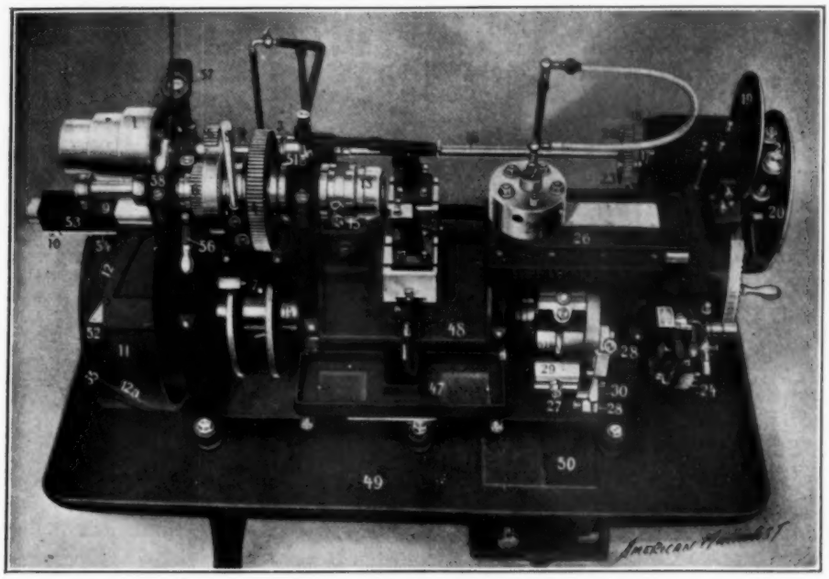


Fig. 1. German Automatic Screw Machine

The index at right side of Fig. 1 shows the exact feed for tools as well as for threading. The turret is advanced by means of adjustable roller 27. For a long stroke the roller is moved to left of drum and for short stroke to right. This roller is adjustable to any place on drum, hence it is clear that one can very easily combine the use of turret tool with forming or cutting-off tool.

Skipping Turret Holes

In case a hole can be skipped roller 27 is simply slid out of place and the turret is indexed by means of roller 28 without being advanced. This one feature permits of many combinations which would be otherwise impossible, for instance the stock can be fed out a second time, formed and cut off, thus making it possible to produce exceptionally long pieces. The turret has 5 holes and is arranged for oil through drill, die, etc. Attachments such as, eccentric drilling, threading or drilling at high speed can be attached without trouble. Cross slides are independent and can work together in combination with a cutting off tool from above (not shown in cut.)

The turret head can also hold a stop in one of the holes, in which case, however, care must be taken that the feed be adjusted somewhat longer than is necessary for the piece of work, so that the stock can be shoved back to the right place just before the chuck closes.

The amount of turret feed per revolution of the work spindle is easily adjusted according to a scale. This feed can be different for each tool, which is attained by adjustment of the intermediate roller 21 between friction disks 19 and 20, by means of the lever 32 (Fig. 2) and the tripper cams 33, 34, 35 and 36; the latter being used only for thread cutting.

The clutching, or throwing in, of the turret head is performed in its end position by means of the block 37. If need be, two or three tool holes may be thrown in, one after the other, without forward motion by placing as many blocks (37) directly behind the roller holder 30, as there are holes to be thrown in.

The Chucking Mechanism

The chuck is operated direct through lever 15 and can be operated by hand by means of a hand lever not shown. Chuck jaws are solid and fitted in a hardened and ground head. Stock feed is regulated by scale 10 and as soon as end of bar is drawn out of feed shell the whole machine as well as countershaft is stopped instantly by means of sliding cam 52.

The finished parts do not drop in chips when cut off but run down incline 48 and drop in pan 47, the chips dropping in between.

The machine takes 7/16-inch stock and feeds normally 2 inches. It consumes 1 horsepower when running at maximum speed. It is built by Lüdw. Loewe & Co., Actiengesellschaft, Berlin.

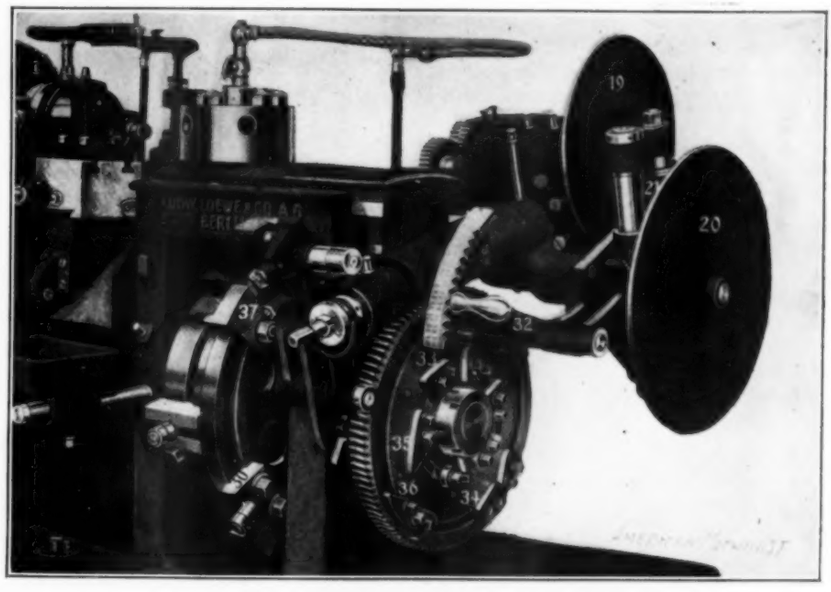


Fig. 2. Details of the Chucking Mechanism

From experiments conducted by the author of a paper presented to the Institute of Marine Engineers, dealing with the subject of lubrication in marine engines, it appeared that the best oil for any bearing was the thinnest that would keep the surfaces apart, and that thicker oil involved a waste of energy and of fuel, which might be measured by the higher temperature developed on the bearing to reduce the oil to the viscosity appropriate to the work to be done.

Computing Scale Company's Plant

By F. A. Stanley*

A new factory building with saw-tooth roof, covering an area of 255x300 feet and equipped with thoroughly uptodate machinery and tools for the manufacture of a complete line of merchandise scales of various types, including automatic computing scales with cylindrical charts, gravity automatics, even-balance and noncomputing scales.

Details of the shop construction, covering roof trusses, columns, skylights, floors and other features, with a general description of department organization and arrangement in relation to the plant as a whole.

Particulars of tool storage for the press room and general machine departments; special apparatus for enameling; assembling and inspection of work.

*Western editor.

The new plant of the Computing Scale Company, at Dayton, Ohio, is of saw-tooth construction, with brick walls and steel columns and roof trusses, as represented by the accompanying halftone and line engravings. The factory proper is 225 feet in breadth and 300 deep, and there are 11 saw-tooth sections or bays, of 24 feet 10 inches span, seven of which extend the full length of the building frontage, or 255 feet, while the remainder are 85 feet shorter, owing to the fact that a shop building already occupying a portion of the premises when the new structure was undertaken was retained for certain manufacturing and storage purposes, and the abutting saw-tooth bays of the new shop are, therefore, reduced in length by the distance that the original structure projects into the new factory area.

The office building extends along the eastern end of the new shop, and on the street front the saw-tooth construction is displaced by a two-story brick erection which provides a loft or second-floor area of 250x24 feet, which is utilized for special operations, such as experimental work, etc. The general appearance of the complete plant is well illustrated by Fig. 1, and exterior and sectional elevations are shown in Fig. 2.

Saw-tooth Details

Details of the saw-tooth construction are presented in Fig. 3, and this drawing, with the various interior illustrations reproduced from photographs, brings out clearly the different features of importance. As already noted the span from center to center of columns is 24 feet 10 inches, and the hight from floor to lower member of roof truss is 12 feet. The 8-inch I-section columns are carried on concrete piers in accordance with the plan in Fig. 4, which also shows the general arrangement of the shop departments.

Examination of Fig. 3 will show the details and dimensions of the members of the roof truss; the braces and carrying plates for the columns; the arrangement of the L's for carrying beams for countershaft supports; the roof purlins and sheathing; the skylight proportions, flashing, etc., and the arrangement of gutters. Fig. 2 gives a sectional elevation along one of these roof gutters and shows clearly the method of pitching the watersheds between the bays. The leaders outside of the walls and passing down through the shop, are connected with storm sewers located under the building, but not indicated in the plan.

Shop Floors, Heat and Power

The detail drawing, Fig. 3, also shows the character of the shop floor. This is constituted of 2-inch planks laid on 4x4-inch oak sleepers resting on a 4-inch thickness of grouting and bedded in cinder concrete, which is hollowed on the upper surfaces between the sleepers to form an air passage and prevent dampness of the floors.

There is also a system of conduits under the floor for the transmission of hot air to various points for warming the building, this system being used in conjunction with steam-heating pipes placed around the walls and overhead.

The machinery is operated under the group-drive system with electric current taken from the city lines and lighting current is obtained from the same source. The equipment of the different departments, and the nature of the operations carried on, are well illustrated by the halftone engravings, Figs. 5 to 13, which reveal many features of interest, such as the neat and orderly grouping of machines, benches and apparatus; the facilities for handling large quantities of small and medium-sized castings and other parts machined by the thousand; and the system of automatic sprinklers, pipe lines and electric wiring; the highly satisfactory lighting effect produced by the saw-tooth arrangements, which, as will be noted, is represented clearly in many of its important details, in these interior views.

As might be expected in a plant of this nature, adequate toilet facilities are provided for the operatives, and at numerous points about the shop, sanitary drink-

Fig. 1. General View of Computing Scale Company's Plant, Dayton, Ohio

ing fountains are installed, several of which are visible in the engravings.

The Machine Department

The halftone, Fig. 5, presents a general view in the main section of the shop, the machine department, where manufacturing operations of a very interesting nature and in almost endless variety are carried on continuously throughout the working day. In the foreground will be noticed several groups of parts, principally levers for automatic scales. This work, however, like other examples that will be seen in the different views, will be referred to only in the briefest manner in this article, which is intended more especially to illustrate the shop as a whole, and the departments in their entirety, and in relation to each other rather than to take up in detail the actual processes of manufacture. Some of these processes and a considerable number of the ingeniously designed tools which enable them to be carried out with accuracy and economy, will be illustrated and described quite fully in subsequent articles.

Punch-press Department

The location of the machine room and its extent are indicated upon the ground plan, Fig. 4. The punch-press department, immediately adjoining the machine section, is represented by Fig. 6. This brings out among other features the method of guarding the pulley and gears of the large punch in the distance by a high gas-pipe railing. Similar guards for other large machines in the department have been erected since this photograph was taken.

The punches and dies used in this shop are of wide variety in form, type and size. One of the largest will be noticed upon the truck, Fig. 7, standing in front of the storage shelves for press tools. The shelves are supported upon gas-pipe standards with cast-iron connecting members, and the length of the structure is about 16 feet. Dies of all kinds are kept here, within easy reach of the presses, and the heavier ones are trucked back and forth with little trouble.

The incandescent lamp hanging in front of the shelves is attached to a cord that is carried by thimbles adapted to slide along a horizontal wire drawn taut overhead, so that the lamp may be drawn along to any point in front of the shelving, where it will hang suspended at the desired hight.

Tool Room and Tool Storage

Between the machine department and the tool room there is a long, narrow room, screened off from both departments, for the storage of jigs, fixtures, cutting tools and small tools of all kinds. There is a most interesting and instructive collection of tools and gaging appliances in the tool stores, and as already stated, some of them will form the subject of special articles in these columns later on.

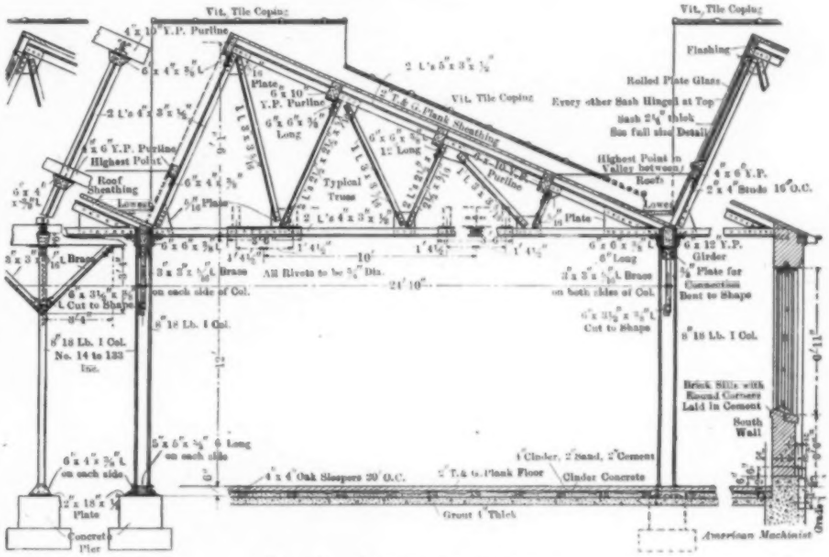
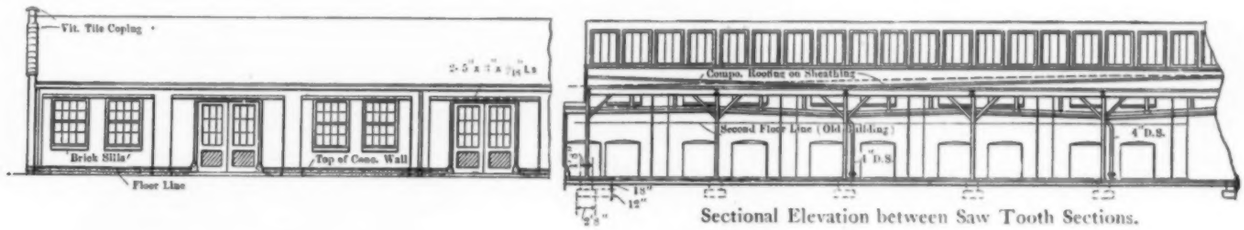


Fig. 3. Saw-tooth Details



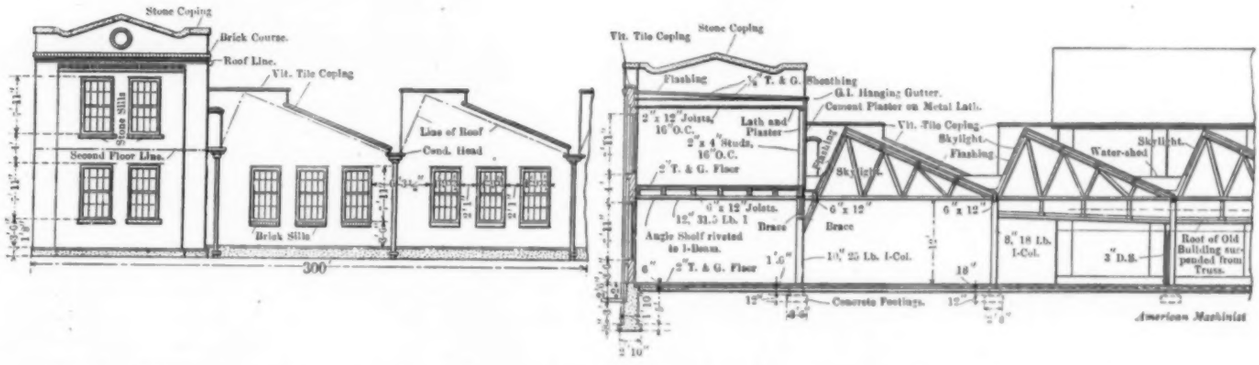


Fig. 2. External and Sectional View Elevations, Showing Saw-tooth Bays, of Which There Are Seven

Polishing, Buffing and Enameling

The view, Fig. 8, in the polishing and buffing room does not give an adequate impression of the extent of the department, but it does, however, reveal the nature of the equipment and shows how thoroughly it is fitted up with exhaust apparatus for carrying away all dust and grit from the wheels and the work.

Fig. 6 illustrates the painting or enam-

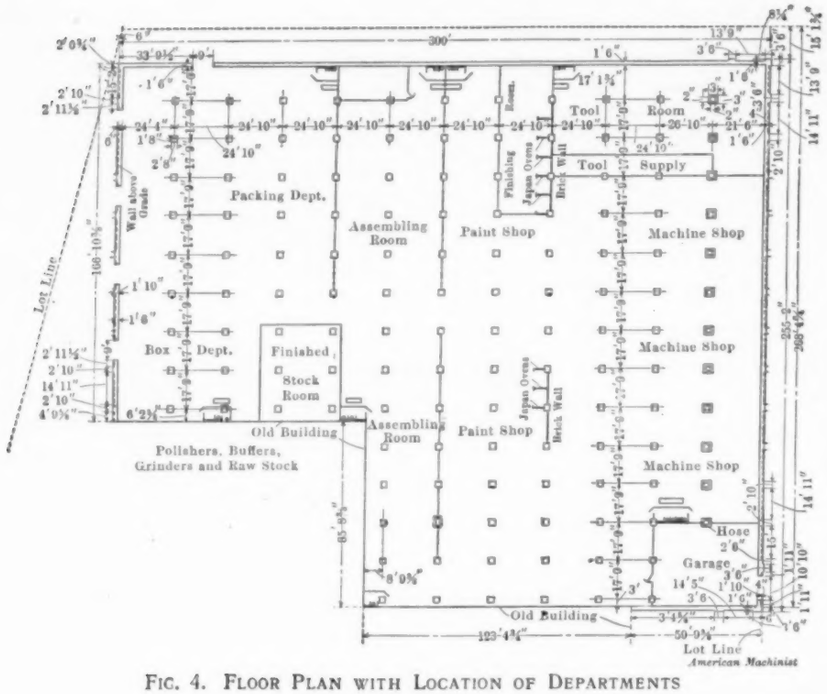


FIG. 4. FLOOR PLAN WITH LOCATION OF DEPARTMENTS

eling of scale parts by spraying the material by means of air blast and nozzle. The air is supplied from a motor-driven pressure blower, and the small rubber tube is attached to a nozzle on a bottle containing the enamel paint. The finished casting or other part to be sprayed is placed upon a circular ball-bearing table in one of the sheet-metal compartments, and the air is then applied by pressure of the thumb on the valve of the nozzle. A little dexterity in the manipulation of the spraying nozzle and in the swinging of the work itself, results in a beautifully coated casting, in a very few minutes.

Following the application of the first coat, the work is allowed to dry thoroughly, after which a second coat is applied and baked on, in about eight hours' time in an oven; this process being repeated until five or more coats are applied.

There are several of the "painting machines" in the group represented by Fig. 9, each provided with its work table, air supply and exhaust connection. To the left in the view will be seen a handy truck that is used extensively in the handling of such material as the frames and other large parts of scales. It is of light, yet strong construction, being made of piping, steel angles and thin metal strips in place of solid platform and shelves. The trucks of this type are drawn directly into the enameling ovens with their loads requiring to be baked. Several others of the same type are visible in Figs. 11 and 12.

FIG. 5. THE MACHINE DEPARTMENT

FIG. 6. PUNCH-PRESS DEPARTMENT

FINISHING, ASSEMBLING AND SEALING

The finishing section of the enameling department is shown by Fig. 10, and the assembling benches are seen in Fig. 11. The nature of the operations here is more or less evident, but it may be pointed out that every man engaged in this work has upon his bench, a handy auxiliary table for facilitating the swinging about of the material he is handling. This table is the regular revolving base of one of the types of scales made here and any casting or partly assembled machine being handled upon the bench can be readily turned about on this table one way or the other, and swung back and forth to the various positions desired by the workman, with little or no effort upon his part.

APPLICATION OF TEST WEIGHTS

In testing preparatory to sealing in the department shown in Fig. 12, the scales are mounted upon rigid cast-iron benches, which serve as surface plates, and while held perfectly level, each scale is tested up to its maximum capacity by the application of weights. Each scale is tested for fineness to its smallest unit.

With the automatic scales which are shown in large numbers in Figs. 1 and 2, and which are provided with a graduated chart upon a horizontal, revolvable cylinder, the process of inspection involves a critical examination of the action of the chart cylinder at each application of the test weights. The cylinder or drum is very sensitive, as it is exceedingly light and mounted between ball bearings to re-

duce friction to a minimum. The inspectors regularly engaged upon this line of work, however, become proficient in the handling of the test weights and in checking the accuracy of the corresponding movements of the chart.

The box and packing departments are at the rear end of the plant, as indicated upon the plan, Fig. 4, so that the product as assembled, tested and sealed, is transferred in natural order to the packing division immediately adjacent, and after boxing, it may be conveniently loaded for shipment on cars at the rear doors of the factory.

Another Trade School Plan

By E. F. Henry

I have recently been able to visit a number of the newly established trade schools of Massachusetts and Connecticut. While all of them are to be commended for the serious, earnest way in which they are approaching the subject, it seems to me that most of them are in danger of future development which will not follow the lines of their present intentions.

There appear to be three schemes, the Fitchburg plan, the Beverly plan and the Worcester plan. The Worcester plan is the only one that has been adopted by other cities in any degree. The copies in general miss the main point, that of commercial productivity. This is also the main point of the Fitchburg and Beverly schools.

Of the three, Fitchburg seems to fail in that there is no special instruction in shop work which is the place of all places where special attention to instruction is needed. Think of a trade school with no one to "teach" the trade!

Fig. 7. Storage Shelves for Press Tools

The Worcester plan appears to fail in that it does not reach that element of our population that needs trade training most because they cannot afford it. The Worcester school and the others on the same plan, have plenty of pupils, but they appear to me to be of a class that will expect to become foremen and superintendents rather than remain skilled workmen. There must be five poor boys who need to learn a trade and are rightly constituted to do so to one that can afford to spend four years without pay. It is, of course, perfectly easy to figure that these four years may be time well invested, but if a boy cannot raise the money to live on, or if he has mother, brother or sister to support, then free trade education is a promise that cannot be fulfilled. Worse than that, these schools run such long terms that there is practically no opportunity for boys to be self-supporting.

To be sure we hear of boys getting up at 2 o'clock in the morning and working in newspaper offices or running newspaper routes or peddling milk, but these are rare cases and hardly desirable for growing boys. It is easier for a boy to work his way through the high school and college than to work his way through these trade schools.

The Beverly Plan

In my opinion, the most ideal of all these plans is the one at Beverly. The drawback to this plan is that it is totally inapplicable in 99 per cent. of other communities. In Beverly it is right. There, the United Shoe Machinery Company is the whole town from a shop point of view. They set apart a portion of their shop for apprentice work. They assign men enough to take charge of the work to handle it adequately. The shop furnishes work for the boys to do, and pays boys and men just as they did when the machines were scattered about the shop.

The machines are the same as were used before, they take up no more room than they did before. From the standpoint of the company, I see no difference. The boy is vastly better off, in that instead of being thrown upon some workman with no incentive to learn he is put under control of an expert whose salary is gaged by his ability to train the

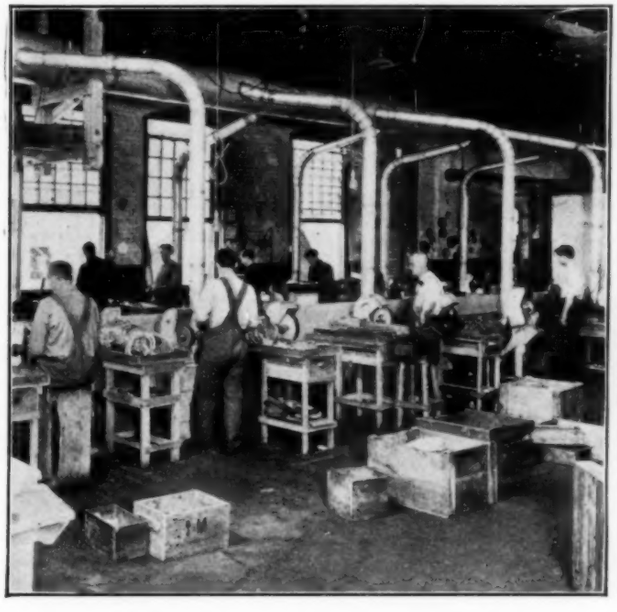


Fig. 8. Polishing and Buffing Room

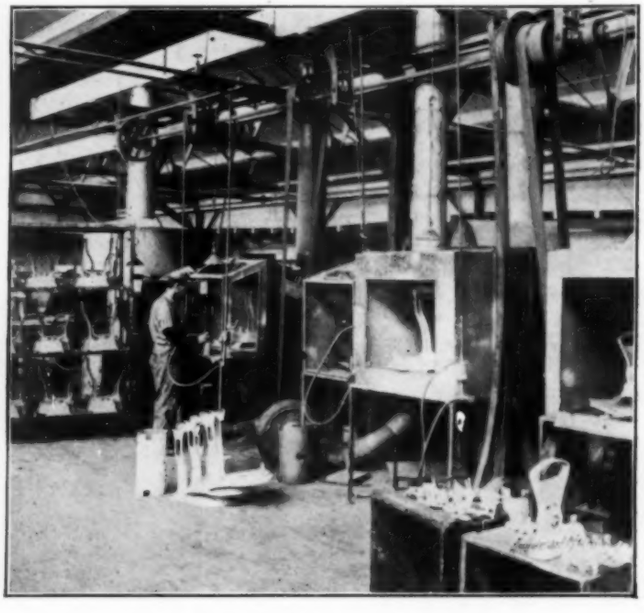


Fig. 9. Enameling Apparatus

boys, rather than by the output he can get. Again the shop is a gainer in that by alternating boys week by week they train twice the number of boys that they otherwise might. The class-room work in all these schools is similar in its intent and, while much might be said about it and its variations in different schools, it is enough to bear in mind that it is equally possible for all these types of schools to give good work and get good results.

covered by men who live at home and work in their shops, find out from them how many apprentices they would take if they could get them, and whether they have the equipment to care for them. Suppose the list is like this: A wants 20; B wants 10; C wants 12; D wants 4; E wants 14; total, 60.

It is evident that here is a nucleus for a half-time school with 120 pupils, subject to drawbacks noted above and then

whole number. Also it is evident that these employers have sufficient work to keep these boys busy at all stages of their development, and that they expect to pay them wages for doing the work or else put them on piece rates.

An Educational Corporation

The next step is the natural one of forming a corporation. The capital may be anything desired according to the tax

Fig. 10. Finishing Enameling

Fig. 11. Assembling

Now it occurred to me that it ought to be possible for other cities to benefit by the Beverly plan.

Difficulties to Overcome

The difficulties likely to present themselves are as follows:

1. Most cities have more than one industry employing machinists. Each industrial establishment will want and ought to have equally desirable graduate machinists to pick from.

2. Not every shop is large enough to have a sufficient number of apprentices to make it possible to have an instructor to care for them alone.

3. If the second condition is favorable there still remains the impossibility of making the school room correlate with the shop work, because the shop work will be different in every shop.

4. If the instructors cannot follow the boys from shop to school to some extent, the boy will suffer through the lack of comprehension, on the part of the school instructors, of the needs of the shop.

My suggestion as a remedy for these difficulties and a few more not noted above, is as follows:

The First Step

Let us call together all the shop proprietors in a city or in a radius easily

some others. It is also evident that A proposes to tie up practically 20 machines of one kind or another; B, 10, etc., also that no one of them would likely have a man who would devote all his time to his apprentices, between them they would be giving up the time of different men, aggregating enough to cover an adequate corps of instructors for the

laws of the State in which the scheme is to be tried. If it is necessary to have some tangible assets as a basis of capitalization, someone ought to be willing to chip in a patent or two at $100,000 or so apiece. I have a couple myself that are not working that I would contribute to any worthy cause. Having satisfactorily settled the capitalization, the

Fig. 12. Inspection and Sealing Department

next move is to divide the capital into 120 shares and hand out the shares to each concern as fast as he contributes a boy. One boy, one share; no boys, no shares.

This corporation now is to become a holding company to hold the boys and also the machinery on which the boys would have worked if they had stayed in the original shops. That is, the boys are all to be concentrated in one shop, probably an unused corner of one of the shops for which this holding company pays rent. The holding company likewise hires the necessary foreman and under instructors.

When the stockholders of the holding company send over the boys, they also send over such work as they would give the boys to do in their own shops. The holding company is by this time paying rent and hiring instructors, also buying small tools, waste, oil, etc., but it has no money, not even enough to get its charter and assets framed. It is also getting near pay day for the boys. Next comes an assessment on the stockholders to cover running expenses.

This sounds a little bit harsh, but we must remember that the stock only cost what the printer charged for it and also that the boys began to send finished work back to the factory the first week. This work costs the factory just what its assessment comes to. Cost keeping ought not to be difficult. If the boys are paid by the hour, then the total assessment divided by the number of hours worked gives the rate per hour, cost including overhead charges. If the boys are usually paid by the piece, then the percentage of excess of total assessment over piece rate should be added to the piece rate to get the full cost.

In any event, the only extra cost of running the shop in this way would be the rent of the room and power used, which for 60 boys at a time ought not to be over $3 per boy per month. It is worth that to get the boy out of the way in the shop, and each shop still has the room left for future growth that the boys used before the coöperative shop was established.

Advantages of the Plan

The advantages of this plan over the Ftichburg plan lie in the fact that all the boys get an equal chance; they get real, systematic instruction that is given by men best adapted to teach, and whose aim is to teach by doing practical work.

The boys will have the variety of work that all the shops send rather than the variety that is found only in one shop. They will have the use of a wider range of machine tools than most shops afford.

The advantage over the Worcester plan is that boys whose finances will not permit them to live four years without income, can enjoy the benefits of this scheme. Also the criticism which falls inevitably upon a city institution which does a commercial business is avoided in that all the commercial work would be done by private concern or corporation. Work would come to such a shop automatically, the sales would take care of themselves. Dull times would not affect such a school shop as much as they would the parent shop, in that the amount of work done would be such a small proportion of the total output of the shop that the proprietors would likely keep sending boys and work, whereas, if the parent shop shut down or ran short hours, the boys within the shop would suffer too. The single item of sales is going to be an important matter to schools on the Worcester plan. Men of wide enough acquaintance along commercial lines to be able to dispose of the product are able to command larger positions and they will do so.

In fact, the combination of qualities necessary to successfully conduct these schools is such as to insure their possessor a liberal choice of desirable jobs, in considering which he will likely omit to take this one. On the other hand it would be easily possible to get men to handle the other proposition. Not every man, no matter how good a mechanic, would do, but there are enough who would be glad to draw $5 or $6 a day to take charge of the shop work, seeing that that is all that he would have to do.

Class-room Work

So far I have omitted to say anything about the class-room work other than to imply that the boys would be in class room every other week and that the school work would be made to closely follow the shop work. Any city ought to be glad to furnish the class-room instruction in its regular school buildings.

The Cost

It would cost no more than regular high-school instruction, but it would, of course, have to be made, as it is made in all established trade schools, more shoppish. As to who should do the work of relating the two parts of the work, the shop and the school, that would depend on the men available.

That it would be absolutely necessary for there to be a man big enough to take the shop men and the school men by the scruff of their necks and knock their heads together, goes without saying. He ought to be paid by the city, inasmuch as his work is purely educational, but it would not do to pick out the first high-school principal that you meet to do it. Fortunately there are to be found a few men with teaching records who have also stood up in front of a lathe.

These men are the ones that are needed, for men of one calling alone will not respect the other, whereas, a man who has met the difficulties of both realizes that either one is a man's job by itself.

I feel that this plan has the merit of applicabilitiy to other trades than the machinists. Any trade which is practised in a shop can be handled in this way, because even where the work cannot be entirely completed by the boys, it can be sent, incomplete, to the home shop to be finished. Field work, like bricklaying or carpenter work, could also be handled by sending a group of the boys under a subinstructor around on different jobs of the coöperating builders, as the work came to the stage that they were ready to take up. In any of these trades there would be a distinct advantage in that the scheme could be started with boys in all stages of apprenticeship by simply transferring apprentices already working to the school shop, so there would be boys from the beginning in various stages of advancement, instead of having to begin a school with all green boys.

Suggestions from a Cincinnati Shop

By Geo. Langen, Jr.

The Cincinnati Planer Company has a method of numbering machines by using a transfer with a gilt finish instead of the old-fashioned brass plates which have been so common. These numbers are 1½ inches on small machines and 3 inches on large ones, a coat of dull varnish being applied after they are put on in order to protect them and allow them to be wiped clean.

All machines of the same character have the number in the same place. This makes it convenient for the timekeeper as the time cards are marked with the number of the machine on which the operation is performed. It is also convenient to truckers, as the tags that go with each piece of work not only describe the operation but also tell what machine is to do it. This prevents any attempt to do work on one machine when a special appliance has been made for this work on some other.

The time bells are rung by a clock regulated by the Western Union Telegraph Service, so that they always record the correct time and do away with the uncertainty of depending on any one man to ring them at the specified time.

I noticed that the floor was unusually clean for a large shop, and was shown a large sweeper somewhat similar in design and construction to the small household sweepers. It is about 4 feet wide, stands about 2 feet 6 inches high, and works in practically the same way as the smaller sweepers. It seems to pick up all dirt, as well as small chips and pieces of metal that are not too heavy.

Germany's production of machinery for the first eleven months of 1910 is given as 416,988,000 marks; say, $104,000,000.

Testing Surfaces with a Glass Plate

By L. P. Alford*

A simple and valuable method of testing plane surfaces—as the surfaces of size blocks—by bringing them in contact with the accurate surface of a piece of glass and noting the bands, or fringes, of color.

*Assistant editor.

In the shops of the Pratt & Whitney Company, Hartford, Conn., has been developed a method of testing lapped surfaces that is very simple, inexpensive—for tools, it requires nothing but a piece of glass having one accurate plane surface—and possessed of extreme sensitiveness and accuracy. This method and its application deserve to be widely known.

The principle behind the method is the same as the principle of the interferometer. The interferometer is defined as "an instrument for measuring very small distances and angles in terms of the wave length of light." It furnishes the most perfect means known for testing the accuracy of a plane surface, or a straightedge or a precision screw. It is based upon the phenomenon of the interference of light; likewise the method of testing lapped surfaces upon which this article is based employs this same phenomenon.

It is beyond the purpose and space of this article to explain the interference of light or to describe the interferometer. Readers who desire to investigate these subjects are referred to the AMERICAN MACHINIST, pages 772 and 799, Volume 34. These two articles give in a clear and simple way the principle of the interference of light as used in the interferometer and show applications of that instrument to various machine-shop measurements. The phenomenon of light interference is seen as parallel or concentric bands of light or color, or blotches of light or color, called fringes, separated by a greater or less distance, and upon surfaces close together where there is both external and internal reflection. A common example is the rainbow colors seen in the films of oil in the machine shop. Here the colors are in irregular spots, owing to differences in the thickness of the oil film from the surfaces of which the light is reflected. The number and arrangement of these bands indicate the error in parallelism of the surfaces that are reflecting the light. Dark and light bands or fringes may occur when monochromatic light is used.

THE METHOD OF TESTING

Taking now the lapped surface of a size block and the accurate plane surface of a piece of glass; if these two surfaces are brought into close contact, on looking through the glass we see bands of color; these bands show the presence of a minute air film between the surfaces. The surfaces that bring about the interference of light by reflection are the surfaces inclosing the air film. Thus, if the glass is of known accuracy, we at once have an indication of the accuracy of the surface of the block. This is the application of the principle of the interference of light in the method developed at the Pratt & Whitney works, and used in testing glass surfaces for many years.

Turning to Fig. 1, we see a very accurate ½-inch size block that while being lapped was tested with the piece of glass also shown. As an indication of the accuracy of the block it has been very carefully compared with a set of Swedish gages, both for thickness, parallelism of the surfaces and truth of the surfaces; so far as I am able to judge from this investigation it is fully equal in all respects to the Swedish product.

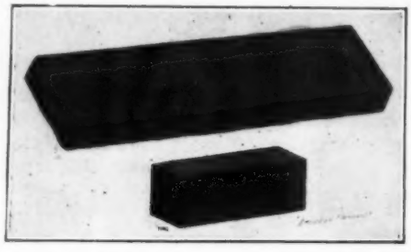


FIG. 1. THE GLASS PLATE AND THE BLOCK

The testing merely consists of first cleaning both the surface of the glass and the surface of the block to remove all oil, dust and other foreign particles, rubbing the two surfaces into close contact and noting the color bands, or fringes, if any appear, first waiting for the glass and steel to come to an equal temperature. Thus high and low spots are at once seen and the lapping can be continued to correct the error and produce a very perfect surface.

The fringes shown in this way in daylight are of brilliant colors, reminding one of a spectrum. In the interferometer a single color of light is used, the yellow light of sodium being the most common.

From the fact that daylight or white light is composed of all of the colors, and even after these colors have been broken up by interference if superimposed they will still produce light that is white to the eye, it is impossible to see these fringes if the surfaces are much more than 1/10,000 inch apart, but with monochromatic light, the surfaces may be tested if they are much farther apart. The lengths of light waves differ for different colors. Red is the longest; 0.000025 inch in length. From six to eight fringes are all that can be detected by the unaided eye when white light is broken up by interferences, and this indicates a separation of the surfaces of about 1/10,000 inch.

Thus, at the outset, before this test can be made, the surface of the block must be lapped to an accuracy within about 0.0001 inch.

HOW THE LAPPING WAS DONE

The method of lapping that was adopted in the case of the size block shown, was to use the corner of the lap in order to keep the ends of the block a trifle higher than the center. This corrected for the usual tendency in lapping, which is to bring the corners low and the center high. Frequent testing against the glass plate showed how the surface was coming. At the finish it was only necessary to bring down the corners to the level of the center and the splendid surface that we have described was produced.

The piece of glass used is nothing but a small piece of French plate glass, selected for accuracy of surface by testing it against a surface of an accurately lapped prism from the laboratories of Doctor Brashear, in Allegheny, Penn. It may surprise others, as it surprised me, that even by careful selection, a piece of plate glass could be found that possessed such a surface. If this method is adopted in any other shop it will be wise, however, to obtain a piece of glass from an instrument maker having one optically accurate plane surface.

FRINGES FROM THE SIZE BLOCK

We will now turn to Figs. 2 to 8, which show reproduced from original sketches the fringes of color as seen when the size block and piece of glass have been put together under various conditions. A fringe of color shows when the thickness of the air film between the surface of the glass and the surface of the block is a half wave length of light. For example; if the two surfaces were perfect planes and were in contact at one end and slightly separated at the other, so that we saw three fringes across the block, the first fringe would indicate a separation of one-half a wave length of light, or 0.000013 inch for red color, the second would indicate a dis-

tance of 1 wave length, the third a distance of 1½ wave lengths, and so on. As mentioned above, if the distance was greater than about 1/10,000 inch, no fringes would be seen at all with the unaided eye in *white light*.

Fig. 2 indicates the plane surface of the size blocks without any color fringes. This condition is easily obtained by pressing the block into intimate contact with the glass plate, so much so that the plate probably springs very slightly to meet the surface of the block. In this condition the block adheres to the glass with the same firmness as does a Swedish gage.

FIG. 2

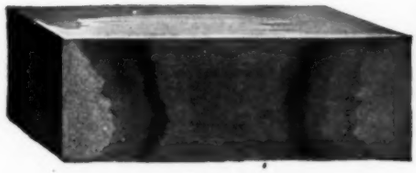


FIG. 3

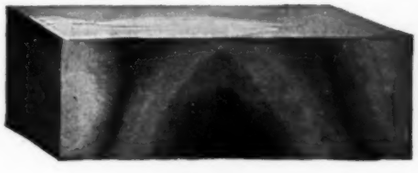


FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

COLOR BANDS SEEN BETWEEN SIZE BLOCK AND GLASS

In case the block is rubbed into contact with the glass on one side, the fringes have the appearance of Figs. 3 and 4, and on the other side, as in Fig. 5. In Fig. 3 the result of the method of lapping is plainly seen in that the ends are high and are in contact with the glass, and the center is a little low. As only one fringe appears on the edges of the contact, we believe that this center is not lower than ½ a wave length of red light, the predominating color, or, say, 0.000013 inch.

Fig. 4 shows a slightly different position of block against the glass plate, and while the bearing is still at the end of the block, there are now two fringes at each end instead of one. This indicates a separation at the center of the block, equal to about 1 wave length of red light, say 0.000025 inch.

Fig. 5 shows four fringes seen from the other side of the block.

Figs. 6, 7 and 8 show fringes obtained by springing the glass away from the size block with the fingers after the block has been pressed into such intimate contact with the glass that no fringes were visible. In Fig. 6 the glass was sprung away from the block at one corner and the fringes are seen to be roughly concentric around that corner. In Fig. 7 tne block was sprung away at one end, the fringes are seen to be convexed away from the end that is lifted.

In Fig. 8 both ends of the plate were slightly sprung upward and fringes are seen near each end.

It must not be thought that these bands of color always arrange themselves with such regularity, for instead of showing as distinct separated lines, they may merely show as blotches of color, such as one frequently sees in an oil film. It is only when the surfaces are accurate that the fringes appear as straight, parallel and equidistant lines, indicating a wedge-shaped air film between the surfaces.

The simplicity of this method must appeal to everyone who has read this article. It is difficult to conceive of an easier way of testing a small lapped surface for truth than by bringing it in contact with an optically accurate glass surface, noting the color fringes, seeing where the surface is inaccurate and at the same time estimating the degree of this inaccuracy. It is a method that any toolmaker can try. The only tool needed is a piece of thick glass with an accurate surface.

It may be well also, to have in a darkened corner, a bunsen burner, the tube of which can have asbestos wool cemented to its upper end by silicate of soda, and saturated with common salt so as to produce monochromatic light (sodium light) which will show dark and light bands alternately in the test, and by which a piece may be tested when the surfaces are farther apart than if white light is used, with the further advantage of increased sensitiveness.

Remember, that each band or fringe of color or darkness, indicates an error of only one-half the length of the wave of the light used. If, when using red light, we have eight dark bands, the error or difference in the thickness of the air film separating the two surfaces is only four wave lengths of red light, and since the length of the red wave is practically 1/40,000 inch, the difference in thickness of film is only 1/10,000 inch.

In the investigation conducted at Sevres by A. A. Michelson and others to determine the length of the standard meter, the following number of waves per meter, and per inch, were found: For the red radiation of cadmium, per meter 1,553,163.5 = 39,450 per inch; for the green, 1,966,249.7 = 49,942.3 per inch; for the blue, 2,083,372.1 = 52,917.2 per inch. The above calculation was made assuming 39.3704 inches in one meter.

It may be possible that some such method as this is the one used to test the Swedish gages whose accuracy has been a common topic of shop conversation in American machine shops during the past two years. This same principle of the interference of light can be used not only to determine flatness of a surface, but to determine the parallelism of two surfaces and also to measure the distance between them. It, therefore, seems possible that a shop instrument could be designed which would permit of making all of these indications or measurements and be an important factor in the commercial manufacture of accurate size blocks.

An Improved Type of Valve Grinder

BY R. W. HUTCHINSON

One of the most exacting operations in the building of a first-class automobile motor is the correct fitting of the poppet valves, as it is upon this detail that the compression and the power derived from the motor depend. Several ing success, but it is generally conceded that grinding or wearing in the valve upon the seat is most satisfactory and this operation has almost invariably been performed by workmen with hand-operated tools, for it was considered impossible to duplicate the peculiar motion necessary for perfect results by any auto-

matically operated mechanical device, but the personal equation enters into this method, and the inaccuracies which naturally follow make the results uncertain at all times.

It has been found impossible for a workman to hold the tools in such a position that unequal wear does not occur on one side or the other of the valve seat, owing to the bending of the valve stem. Fatigue, due to the incessant motion was also a serious factor, and the workman was inclined to neglect the finishing of the valve and valve seat, which resulted in imperfectly fitted valves, requiring constant attention and frequent regrinding.

Many attempts have been made to design a machine which would satisfactorily take the place of hand labor and a valve grinder, designed and patented by J. F .Higbee, is now in use at the factory of the Inter-State Automobile Company, Muncie, Ind., and it has given universal satisfaction since its installation. It grinds with absolute accuracy a complete set, or eight valves, simultaneously, the time required varying between 10 to 12 minutes for a completely finished set, while the old hand-grinding operation required from 30 to 45 minutes for each valve, and in view of the fact there were many valves imperfectly fitted, the last average is very conservative.

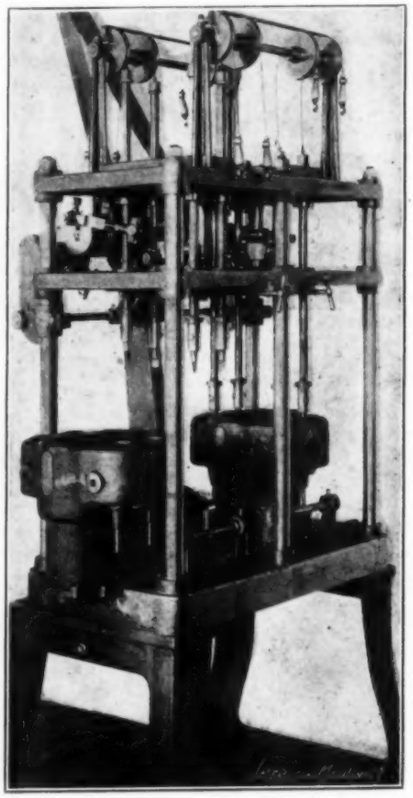
A small machine of this type was described in the AMERICAN MACHINIST, page 1080, Volume 33, Part 2, but the one shown is so much larger and improved so much in every way that the resemblance is hardly noticeable.

Before adopting the machine, the Inter-State company kept a careful and accurate record of the old hand-grinding process, and found that the average number of valves ground by each workman in a working day of 10 hours was one and one-half sets, or 12, but with the machine here illustrated, 40 sets or 320 valves have been ground in 10 hours, and the attention of one man only was required, and he also had time to test each valve to determine whether it was perfectly fitted.

The saving in time accredited to the use of the machine was enormous, and it has been estimated that the one machine, in the 12 months of its operation, effected a total saving of $5000, or $2 to each machine. This estimate does not take into consideration the time which would have been required to regrind valves fitted by the old hand process, nor does it show the satisfactory operation of the valves ground by the machine.

The basic idea of the machine is to produce the progressive reciprocating motion of the valve, as done in correct hand grinding and to preserve the proper position of the valve-operating spindle. The motion is produced by a ratchet and pawl combination, the four spindles required for turning the valve in each pair of cylinders being operated simultaneously. The illustration shows one pair of the cylinders of a 50 horsepower motor in position, with the spindles in the driving position on the valves, and one pair partially removed, showing the ease with which the cylinders may be interchanged.

The spindles are set over the exact centers of the valves and so transmit no side thrust to the stem. They may be raised singly to inspect any valve without suspending the action of the other seven, or the four spindles required for each pair of cylinders may be stopped and raised to permit of changing the cylinder without stopping the other four spindles. The lower end of each spindle is provided with a self-centering bit, which readily engages with the slots on the upper



AN IMPROVED VALVE GRINDER

side of the valve head, and when these bits become worn, they may be very easily removed and new ones substituted.

The valves are raised from the seats at regular intervals by cams upon a shaft which is located just under the ends of the valve stems, which permits the grinding element to work down under the surfaces which are being ground, and makes it unnecessary to stop the machine to perform this function.

The machine is driven by a belt from a loose pulley, and a clutch is provided for each set of spindles by means of which either set may be operated independently of the other. The clutches are engaged by means of the small "T" handles shown. The small pull handles on the ends of the cables which run over the pulleys at the top of the machine are used to raise the spindles and to hold them in position while they are idle. The cam shafts for each pair of cylinders are driven by chains independently of the others, and are started and stopped with the spindles.

A Time Chart

BY HERBERT L. SEWARD*

The accompanying chart is intended to give at once, in a simple manner, the time required to turn a piece of work of given length and diameter at a given cutting speed with a given feed. It is based on the following formula:

$$T = 0.2618 \frac{LDF}{S}$$

where

T = Time required to machine piece in minutes,
L = Length of piece in inches,
D = Diameter of piece in inches,
F = Feed in number of revolutions to one inch travel,
S = Cutting speed in feet per minute.

The chart consists of four parallel scales: (1) Scale F, which reads on one side of the line in decimals of an inch and on the other in revolutions per inch of travel; (2) scale S; (3) scale T, which gives the time in minutes on one side and the corresponding number of pieces per hour on the other; (4) scale P, which is a scale of the *product* of the length and diameter of the piece of work to be turned. Values on it may be found either mentally or by means of the auxiliary scales to the right of it, by placing a straight-edge across from given length and diameter to scale P. Between the four principal scales is placed a center line A.

If a line were drawn from any point on scale F to any point on scale P, it would cross center line A. Similarly if another line were drawn from any point on scale S to any point on scale T, it also would cross the center line A. If these two lines cross the center line at the same point, the four numbers thus connected will satisfy the formula given. Any three of these quantities might be given and the fourth required. For example, let it be required to find the time required to machine a piece 2½ inches in diameter, 7 inches long, at a cutting speed of 80 feet per minute, with a feed of 20 revolutions to one inch of longitudinal travel of the tool. Simply place a straight-edge from 20 on the F scale to 17.5 on scale P; note where it crosses line A and swing

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Chart to Determine Machining Time.

By H. L. Seward

This chart is plotted from the formula,

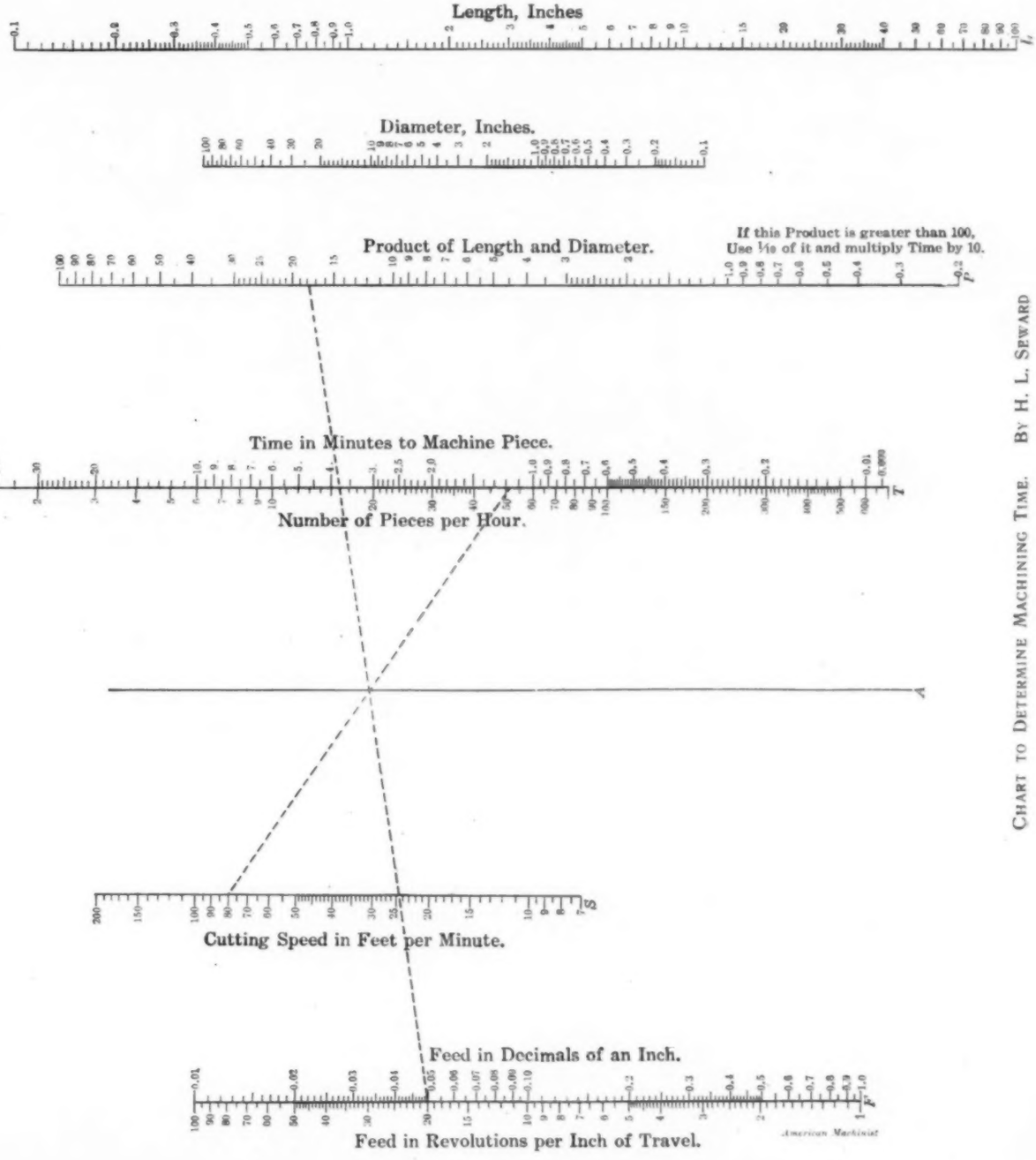
$$T = 0.2618 \frac{LFD}{S},$$

in which

T = Time to machine the piece in minutes;
L = Length of piece in inches;
F = Feed in revolutions per inch of travel;
D = Diameter of piece in inches;
S = Cutting speed in feet per minute.

Explanation: Find the product of length and diameter either mentally or by drawing a line from L through D to the P scale. A line from the P scale to the F scale crosses the same point on line A as a line from the S scale to the T scale.

Example: Given piece 2½ inches diameter and 7 inches long. How long will it take to machine it with a feed of 0.05 inch per revolution at 80 feet per minute cutting speed. As shown by the dotted lines, $T = 1.15$ minutes.



it around until it passes through this point on line *A* and 80 on scale *S*. It will cross scale *T* at 1.15 showing that the piece requires 1.15 minutes to machine. It might be desirable to know what cutting speed would be necessary to turn a piece of given dimensions in a given number of minutes at a given feed. Place the straight-edge across from *F* to *P* and note where it crosses line *A*. Swing it around this point until it also intersects scale *T* at the given number of minutes and read where it crosses scale *S*.

Note that a line must not be drawn from the *F* scale to the *T* scale or from the *P* scale to the *S* scale. The inner two scales are paired together and the outer two paired together, both pairs being connected by the use of the center line.

Instead of using a straight-edge in connection with this chart, a thread with two small weights on the ends may be used if the chart is kept on a horizontal table. Better yet, obtain the narrow transparent edging of an old T-square and scratch a fine line through the center of one side. If a fine needle point be fixed in this line at the center of the strip, the needle point can be pricked into line *A* while the line reaches from *F* to *P* and the strip turned about the meedle point used as a pivot.

The scale for feed may prove useful in itself in place of a table of reciprocals. For example, 4 on the left-hand side is opposite ¼ or 0.25 its reciprocal, on the right. The three scales *L*, *D* and *P* independently constitute a chart of multiplication and division.

It must be noted that the chart is based on *actual cutting time*, with no allowance for the time lost in setting up, changing work, etc.

Drafting Room Lighting Problems

By C. E. Clewell *

The results of experiments prove that a draftsman needs light free from glare and shadows and of a sufficient intensity. Illustrations of several installations show how these conditions were successfully met.

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Drafting work, to an unusual degree, requires an active and constant use of the eyes. Fine lines and much detail must be distinguished, and the handling of measuring scales and delicate instruments makes a demand on the eyes as in few other classes of work. This makes the lighting of drafting rooms a very important feature of their arrangement.

Among the most troublesome features of some methods of lighting for such work is shadow effect along the edge of a T-square, and the shadows cast by dividers or other instruments. The little disagreeable shadow along the edge of the triangle while ruling, is familiar to all draftsmen who have been unfortunate enough to work under a poor system of artificial light. Another feature which may be very harmful is insufficiency of the light.

FIG. 1. HOMEMADE FOUR-LIGHT FIXTURE USED FOR INVERTED DRAFTING-ROOM LIGHTING

In the following notes it is intended to set forth the problems which came up for solution in the lighting of several drafting rooms, and to explain the methods which were followed in providing light which was satisfactory to those concerned in each case.

IMPORTANCE OF GOOD LIGHT

To the casual and uninterested observer all light looks more or less the same. In a careful analysis of the lighting for any specific purpose the question will naturally be asked, why make so much of a simple matter? Few realize or even stop to consider what a large factor the light is in the ease with which work can be performed. Walk through an industrial plant and note the many cases where workmen face a bare incandescent lamp all day, with no thought of the strain on the eye.

Take, for example, a company of people in a poorly ventilated room. After a time all begin to feel uncomfortable, due to the lack of ventilation, while, perhaps, only one and another realize the cause of the discomfort. Like ventilation, the lighting of a room is often a seldom thought of item. This is especially true where the light is fairly good, the refinement of certain features which may be harmful seldom receiving due attention.

The importance of excellence in lighting facilities depends somewhat on the nature of the work. Those engaged in office work where papers are occasionally read, will not need nearly so much nor so excellent light as a draftsman whose work calls for continual and exacting use of the eyes.

The idea that the larger the quantity of light the greater is its excellence is a great mistake. Too much light may often be even worse than too little.

AN INVESTIGATION OF DRAFTING-ROOM LIGHTING

On one occasion an emergency case was presented for solution. A certain drafting room had been rearranged and enlarged. The old lighting system was so poor and the occasion of so much complaint, that it was decided to provide improved lighting facilities in the enlarged portion of the original room. An immediate study was made of the most apparent faults of the old system insofar as this might lead to ideas for improvement.

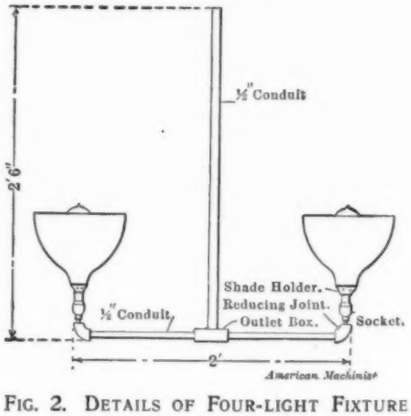

FIG. 2. DETAILS OF FOUR-LIGHT FIXTURE SHOWN IN FIG. 1

Lamps of about 150 candlepower had been used, spaced 8 by 10 feet and mounted about 9 feet above the floor. This arrangement was equivalent to about 2.5 watts per square foot. The faults of this system were threefold:

1. The illumination was not uniform, some desks receiving more light than others.

2. The lamps were too large for such a low mounting hight. A glare was caused by excessive light shining into the eyes of some, and the reflected light from the paper was trying in other cases. This reflected light was due to poor diffusion and also to excessive rays from lamps mounted directly or nearly over certain drawing boards, and reflected from the drawing paper.

3. The shadows were very trying from the small number of large units. This required a constant shifting of the ruling devices and drawing boards so as should be furnished by a large number of small units, no one of which is so intense as to cause eye strain when in the line of vision.

(*c*) *Diffusion.* Shadows should not be noticeable.

(*d*) *Sufficient intensity.* Fine lines and detail should be possible of ready discernment, and tracing work possible without eye fatigue or strain.

In the case of this particular drafting room a number of simple trial tests were performed, making use of various arrangements of lamps, which were temporarily installed in trial bays. Draftsmen were placed in these bays so as to work under the various systems for a short time and thus bring out the defects of each system. None of the systems seemed to yield the desired results, since even with the use of a large number of lamps per bay for furnishing a uniform light, the shadows cast on the paper when handling instruments by all the lamps in the surrounding space caused annoyance and were troublesome*. It was suggested after a few days of experimental investigation that a visit to a neighboring office building be made where favorable results were claimed in a drafting room with the use of the so called semi-indirect lighting system. In the drafting room visited large hemispherical glass bowls open at the top and suspended from the ceiling were in service, in which tungsten lamps were used. In addition to the light which was transmitted directly through the glass to the work, and which may be termed direct light, a portion was cast on the ceiling and in turn reflected downward to the drawing boards. The resulting light seemed so favorable that a trial of this scheme was determined upon.

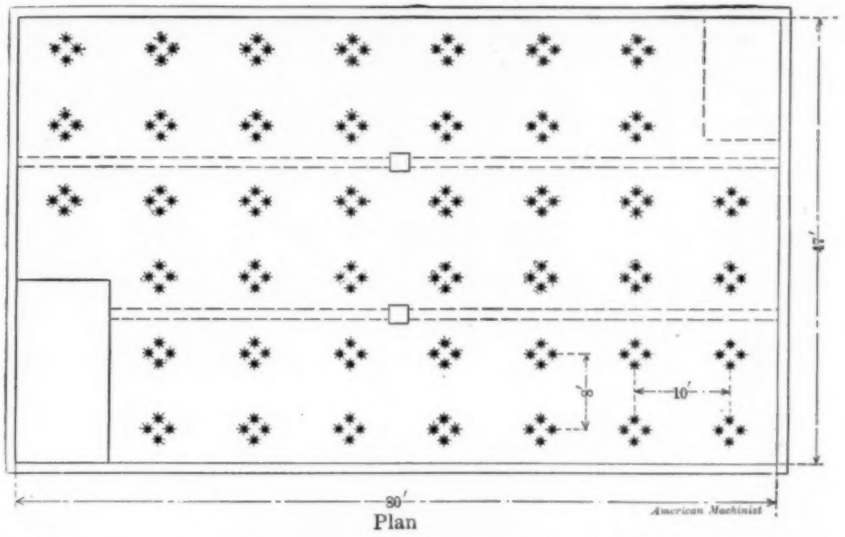

FIG. 3. PLAN SHOWING ARRANGEMENT OF FIXTURES IN A LARGE DRAFTING-ROOM INSTALLATION

SOLUTION OF THE PROBLEM

No large glass-inclosing bowls like those used in the visited drafting room were available at the time, and moreover it was apparent that such a scheme was not very efficient because the glass bowl served only to shield the lamps from the eye, most of the light thrown on the ceiling radiating directly from the lamps. In other words, the glass bowl did not serve as an efficient reflector. This led to the suggestion that several small glass bowls in the form of inverted highly efficient glass reflectors might be used in a cluster with one tungsten lamp in each reflector, rather than a number of lamps in one large inclosing globe.

A homemade fixture, as shown in Fig. 1, was hastily made up of conduit, outlet boxes and suitable joints, and several were installed as an experiment. A number of draftsmen were placed in the space lighted by these experimental fixtures and observations made on the lighting effect. The results were excellent in comparison with any other scheme tried,

FIG. 4. THE DRAFTING ROOM WITH LAMPS AND FIXTURES ARRANGED AS SHOWN IN FIG. 3

FIG. 5. ANOTHER VIEW OF THE DRAFTING ROOM SHOWN IN FIG. 4

to receive the light on the work at the proper point.

Obviously all defects as stated in the three preceding items should be avoided in the new system, and the light should be characterized by the following features:

(*a*) *Uniformity.* The light should be equal in value all over the working surface.

(*b*) *Freedom from glare.* The light

*For more complete information see "Notes on Drafting Room Lighting," by the author in AMERICAN MACHINIST, Volume 33, Part 2, page 1110.

and the experiments were followed by an installation of inverted lamp fixtures in the drafting room to be lighted, the results proving very satisfactory to all concerned.

The absence of shadows was one of the most pleasing features of this system. On entering the room one received the idea of a brightly lighted room and yet with an absence of glare. The intensity was sufficient and all classes of work from tracing to designing were done with ease under the light here used.

Details of the Installation

The installation was made in a room with ceiling hight of 11 feet 6 inches with bays 10 by 20 feet. In each of these bays four 4-light fixtures were placed with a spacing of 8 feet by 9 feet 6 inches. The most advantageous distance from the ceiling to lowest point of fixture was found to be 2 feet 6 inches, determined by illumination measurements on the working surface for different hights of lamps above floor. A reflector with a suitable ratio between the light reflected from the ceiling and the light transmitted directly through the glass, gave a very acceptable result.

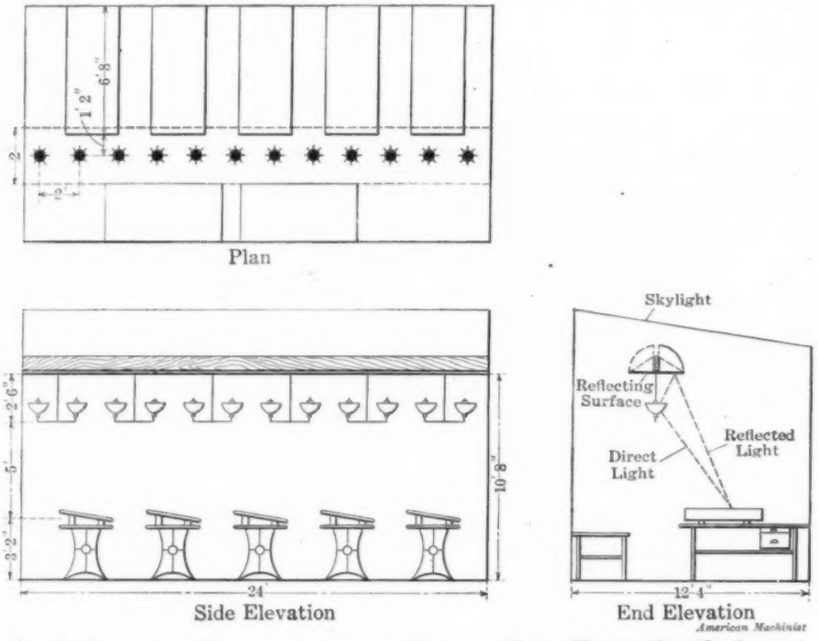

Fig. 6. Plan and Elevations of the Drafting Room Which Had No Ceiling, Showing Arrangement of Fixtures

The System Extended

The installation just described had been in service nearly a year when another and larger drafting room required a lighting installation. This case presented new problems. The main difference was the considerably higher ceiling hight of 15 feet. It was not evident that the system described in the preceding paragraphs would provide satisfactory results with the fixtures mounted as high as 14 feet above the floor. For the determination of this point a portion of the room was equipped with 4-light fixtures suspended by cord passed over screw hooks, these hooks being mounted at the outlet locations. Illumination measurements were taken under these fixtures for various distances between fixture and ceiling. The tests were made with a single coat of buff-colored paint on the ceiling, this one coat having been considered to represent the average condition of ceiling reflection after the freshly painted ceiling, which was to have two coats, had been subject to dust and dirt accumulations. The fixtures were mounted with a spacing of 8 by 10 feet. Illumination tests were made for 2-, 3-, 4- and 5-foot distances from ceiling to lowest point of fixture. The tests showed the intensity on the working surface to be practically the same over the range of mounting hights taken. In order, however, to have the lamps well out of the range of vision, it was decided to construct the fixtures with lowest point 2 feet 6 inches from the ceiling as shown in Fig. 2, where the details of the fixture used in this installation are given.

It is of interest to note in a scheme employing both directly transmitted light and also light reflected from the ceiling as in the case just described, that when the lamps were too near the ceiling, for example less than 2 feet, the spot of light thrown on the ceiling by the reflector seemed too small, and moreover the reflector itself interfered in this case to some extent with the ceiling-reflected light in reaching the working surface. Again, when the lamps were too low, the distance over which the light traveled from the lamp to ceiling and then back to the working surface was so great as to cause excessive losses. On the other hand the lower the lamps the less the distance over which the directly transmitted light traveled before reaching the drawing boards.

Westinghouse "wire type" 60-watt clear tungsten lamps provided an adequate intensity on the working surface. These lamps were used in connection with a reflector which gave a well diffused light free from glare and satisfactory for drafting work. The plan of the room showing the arrangement of the fixtures is given in Fig. 3. Two views of the room showing the arrangement of the fixtures are given in Fig. 4 and Fig. 5. These pictures were taken at night under the artificial light only and were given an exposure of three minutes each.

In these illustrations the significant points to note are the even distribution of the light on the drawing boards and the spot-light effect on the ceiling. Note should be taken that the ceilings are not a uniform glare of light, trying to the eye, but that portions only are utilized for reflection, the remaining part not being brightly lighted.

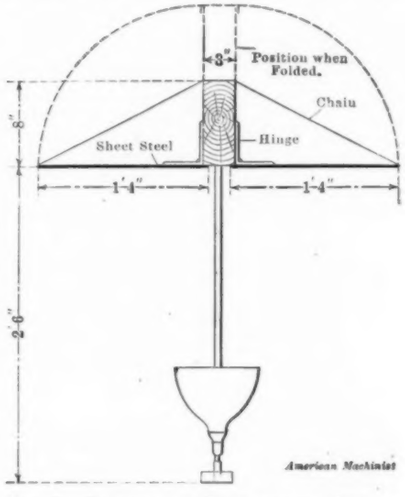

Fig. 7. Details of Reflecting Device Used in a Certain Drafting Room in the Absence of a Ceiling

The walls of this room were finished in a light green tint and the ceiling in a light dull finish buff color. This combination of color produced a soft and pleasing effect and the installation as a whole has given excellent satisfaction. It may be stated that the shadow effect seemed to be accentuated somewhat by the higher mounting hight of the lamps in this case as compared with that of the installation first described, but not to an objectionable extent. This room was lighted by a wattage of a little less than 3 watts per square foot, and average illumination measurements showed an intensity on the working surface of about 7 foot-candles.

Another Lighting Problem

In all that has been said in the preceding notes it will be evident that much

dependence in a system of this kind for drafting purposes, is placed on ceiling reflection. This combination of light transmitted through the reflectors and from ceiling reflection, provides an equivalent light source of large area. The light from this large area is well diffused and of such a nature that shadows are practically eliminated. Hence its popularity with draftsmen.

In one case, however, where a small drafting room required a lighting installation an inspection of the room showed it to have no ceiling, a skylight across the top of the room taking the place of a ceiling. This room was long and narrow and all the draftsmen worked on one side of the office and faced in a given direction. The drawing tables were arranged as shown in the plan of Fig. 6. One scheme considered the placing of all lamps on one side of the room in a row and inverted, providing a reflecting surface over the lamps in the form of a deck attached to the side walls, the idea here being to direct the light to the drawing boards so as to take care of the position occupied by the drawing tables as found, without regard to uniformity of the light.

Another suggestion was to place a line of lamps very close together directly to the left of the draftsmen and overhead, using the lamps in the normal position, pointed vertically downward.

Everything, however, pointed to the use of that scheme which had been found successful in other drafting rooms. To this end it was proposed to board up the skylight with a partial ceiling under which the fixtures were to be mounted much the same as in the large drafting room referred to in the preceding notes. This suggestion was finally decided upon and consisted in placing a reflecting surface at the place where the ceiling would naturally have been found and so arranged that it could be folded up, if desirable, during that portion of the day when artificial light was unnecessary.

Details of the Reflecting Surface Scheme

Two sheet-steel plates were hinged on a wooden hanger as shown in Fig. 7. It will be noted that these plates assume the position shown by the dotted lines when folded.

The under side of these metal plates was first coated with aluminum paint. This seemed to reflect the light without, however, diffusing it, hence a final coating of light dull finish buff-colored paint was used and this produced a pleasing and satisfactory result. Fig. 8 shows a photographic view of this drafting room taken at night with a three-minute exposure. Westinghouse "wire type" 100-watt clear tungsten lamps equipped with diffusing reflectors gave acceptable results. The light has been in service for some time and has been pronounced satisfactory by those working under it. Among its most favorable characteristics are freedom from glare and its excellent diffusion.

Fig. 8. Reproduced from Photograph Taken at Night of the Drafting Room Shown in Diagram in Fig. 6

Summary

In the various cases cited, the main object sought has been the promoting of careful and exacting work in the drafting rooms with minimum eye fatigue. The various experiments have shown that a draftsman requires light free from glare, of sufficient intensity and free also from shadows. It is interesting to note that in these various installations satisfaction has resulted after experimental investigation rather than from predetermination. The opinions of those using the light have been depended upon rather than the photometer or theoretical considerations.

One Reason for the High Cost of Building Automobiles

A few extracts from a recent circular of the Society of Automobile Engineers shows one of the reasons of the high cost of building automobiles in the past and in too many cases, at present. Standardization is one of the keynotes of the work of this association and the need for such work is shown in the examples given.

We do not realize the great waste due to having a multitude of sizes for a simple device, until we take concrete examples as given below.

"That standardization is a good thing is realized by many but the necessity of it would be realized by many more if the situation were fully understood. For example, it is not clear to many of the business men associated with the industry that there is any unnecessary complication of design. They do not realize that there are three or four hundred more dimensions and designs for lock-washers between the sizes of 3/16 and ½ inch than there ought to be.

"Many specify a different gage of metal for every particular part because the draftsman used his own good judgment. The purchasing department goes to the steel maker, who says, 'That is a gage I do not carry regularly in stock', or, 'that is a size tubing that you will have to wait six weeks for.' 'That is a broach for a square hole that we do not carry in stock. It is two thousandths different from anything we have.' It is just as easy for us to cut down the number of gages that are in the market, the number of sizes of tubing and the number of dimensions that are called for in broaches by getting these data together now and embodying them in engineering tables of reference which can be used just as are the rolling-mill tables on steel sections, for instance, at the present time. The National Lock Washer Company is supplying 600 different sizes of lock washers, most of them made to order between the sizes of 3/16- and ½-inch diameter bolts, to pleasure-car builders. We found 1600 different sizes of steel tubing specified by motor-car makers and being rolled by steel mills. One builder was himself specifying eighty different sizes of tubing. Within a year we will probably have the number of sizes of steel tubing reduced to 50, and certainly not above 75. The difference between 75 and 1600 means quality, quantity and economic output."

Irregularity of the Universal Joint

By S. B. Redfield*

Many manufacturers assemble universal joints in such a way that the motion transmitted is very irregular.

A model set in successive positions shows the degree and nature of the irregularity.

Motion may be made uniform if yokes at two ends of connecting shaft are set parallel.

*Associate editor.

Why is it that about half the builders of machine tools put their universal joints together backward? This question may sound startling, but investigation will show that in many cases these joints are wrongly assembled.

One answer is that it just "happens so" in the erecting and another is that those responsible for it do not know which is the correct way, nor that the wrong way makes any material difference.

The Right and the Wrong Ways

First, to get the matter clearly in mind, Fig. 1 shows the correct assembly and Fig. 2 the incorrect. In Fig. 1, it will be observed that yokes *A* and *B*, of connecting shaft *H*, are parallel to each other and in Fig. 2 they are at right angles. If shaft *E* is the driver having a uniform motion, connector *H* will in either case have an irregular motion, due to yokes *A* and *C*; but in the case of Fig. 1 the arrangement of yokes *B* and *D* is such that the direct opposite effect will be produced in this joint and the *irregular* rotation of *H* will produce a *regular* rotation of *F*. This is the case so long as the two angles ø are the same and the two shafts are in the same plane.

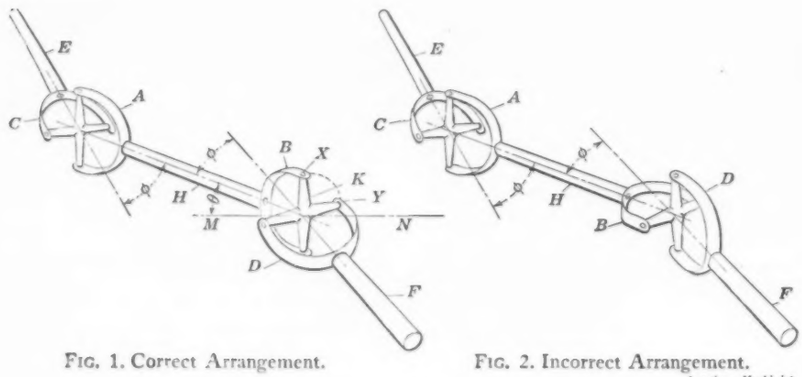

Fig. 1. Correct Arrangement.

Fig. 2. Incorrect Arrangement.

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Arrangements of Joint Parts

In the case of Fig. 2, the effect of yokes *B* and *D* is such as to duplicate the action of yokes *A* and *C*, *adding* the effects and making the rotation of *F* twice as irregular as that of *H*.

Before going into the reasons for this irregular motion, two questions should be disposed of: First, does this irregularity amount to anything in practice; and, second, what difference does it make?

Amount of the Irregularity of Motion

As for the degree of irregularity, one has but to study the halftones, Figs. 6 to 15 inclusive, which show a model made with two commercial universal joints assembled wrongly, as in Fig. 2, and provided with pointers to show the variation during a half revolution. In these views it will be seen that starting with the pointers both at zero degrees, Fig. 6, and then moving the coupled joints so that front pointer *A* stands at 15 degrees, the rear pointer *B* lags about 6 degrees behind *A*. This is shown in Fig. 7. With *A* at 30 degrees, Fig. 8 shows pointer *B* lagging by about 11 degrees. Fig. 9 shows *A* at 45 degrees and *B* about 13 degrees behind. From here on the views show pointer *B* catching up again; for, in Fig. 10, *A* is at 60 degrees and *B* is about 12 degrees behind. In Fig. 11, *A* is at 75 degrees and *B* is about 7½ degrees behind. Fig. 12 shows that *B* again has entirely caught up with *A* and both pointers come to 90 degrees together.

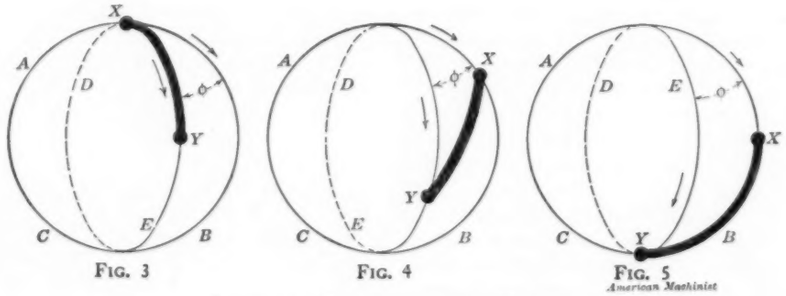

Fig. 3

Fig. 4

Fig. 5

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Steps in Universal Joint Motion

Proceeding with the rotation, the action between 90 and 180 degrees is the direct opposite of that between zero and 90 degrees, for, in this quadrant, pointer *B* has passed pointer *A* and leads it by angles corresponding to those by which it previously lagged. Thus it is seen in Fig. 13 that *A* is at 120 degrees and *B* is about 12 degrees ahead. In Fig. 14, *B* is slowing up again, but while *A* is at 150 degrees, *B* is still 11 degrees ahead. Finally, Fig. 15 shows both pointers again together at 180 degrees.

In this model the angle ø, Figs. 1 and 2, is between 35 and 40 degrees, which is not uncommon in machine work, and it is seen that the variation of pointer *B* from uniform motion, while *A* was advancing in uniform steps, was from about 13 degrees behind to 13 degrees in front, or a total variation of about 26 degrees during a half-revolution. At 270 degrees the pointers again would be together, so there are four points per revolution at which they pass each other, first one lagging and then the other.

Bad Effects of Irregularity

Now, as to the second question; what difference does it make? If it were a matter of indexing there is no argument, for there would be but four points in a revolution at which the driven member would correspond in position to the driver. These joints, however, are not likely to be used for accurate indexing for various reasons; but suppose, as is the usual case, a feed mechanism is driven through a pair of these joints. Is it not reasonable to believe that a jerky feed motion, such as is now seen to take place, might cause vibration due to variation in rate of feed? Is it not, at least, worth while to put the joints together correctly and have a uniform feed motion?

There is a field where this uneven motion may produce serious results. Take, for example, an automobile. The engine has a heavy flywheel and the car has relatively great weight. If the rotation of the engine is uniform, then the car must travel along in jerks or else the shafting must spring. Or, if the car travels at a uniform speed, which is the true case, then either the engine flywheel must respond to the irregularity of the joint motion, or else, as before, the spring of the shafting must absorb the irregularities.

In the ever widening field of aviation, this universal-joint problem might be extremely serious. Imagine a high-speed gasolene engine driving a large-diameter propeller through a pair of wrongly assembled universal joints. How long would the shaft resist the heavy strains set up in it by the violent twisting back and forth caused by the very considerable flywheel effects of both the engine parts and the propeller? First the propeller would lag behind the engine, then it would catch up and shoot ahead of the engine, only to be retarded again in the next quadrant, thus vibrating ahead and lagging behind thousands of times per minute at the high rotative speeds used. And to think that the aviator's life may literally hang upon the holding together of his machinery!

The Reasons and the Cure

Now for the reason for this irregularity of motion and its cure. On page 503, of Volume 33, Part 1, E. J. Stoddard gave such a good explanation of this phenomenon that we cannot do better than study three of his diagrams which are reproduced here in slightly altered form in Figs. 3, 4 and 5. In these diagrams the circle *A X B C* could represent the path of point *X* in Fig. 1, and the circle *D Y E* in Fig. 3 could represent the path of point *Y* in Fig. 1. Then the link *X Y* in Fig. 3 could be applied to the joint in Fig. 1, as shown by the broken, curved line *X Y* in Fig. 1. This link does not lie in the plane of either circle at all times, but swings between the two circular paths as shown in Figs. 3, 4 and 5.

Supposing, in Figs. 3, 4 and 5, that circle *A X B C* represents the path of the uniform motion; it will be seen that in the position shown in Fig. 4 the point *Y* cannot be quite as far down on circle *D Y E* as it would be if the link *X Y* were not lying in a diagonal position. This means that *Y* has been retarded in Fig. 4 by the swinging of *X Y*. In Fig. 5, however, link *X Y* is straight again, having crossed over to circle *A X B C*, and *Y* has been pushed ahead once more.

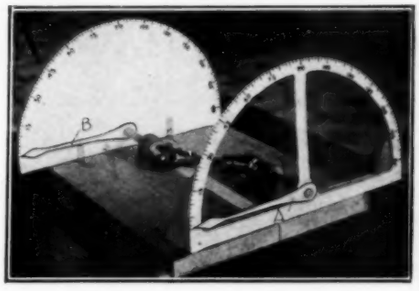


Fig. 6

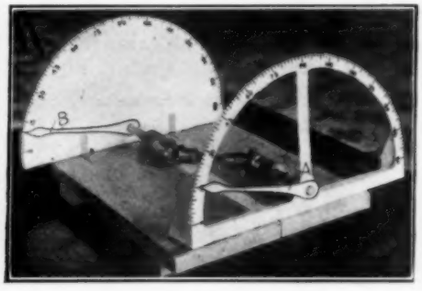


Fig. 7

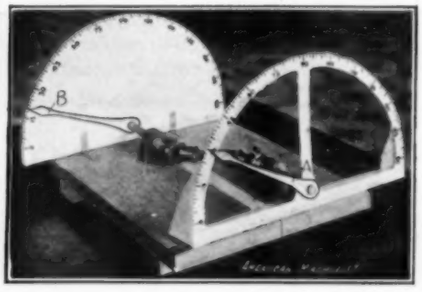


Fig. 8

Model of Universal Joints Wrongly Assembled, Showing Irregular Motion

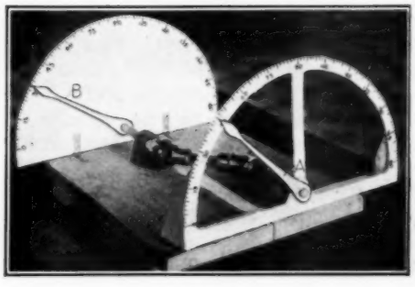


Fig. 9

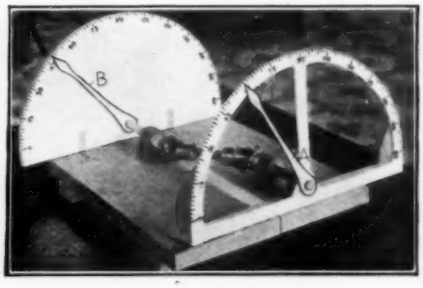


Fig. 10

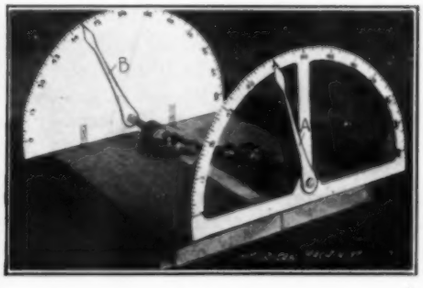


Fig. 11

Further Steps in Irregular Motion of Wrongly Assembled Universal Joints

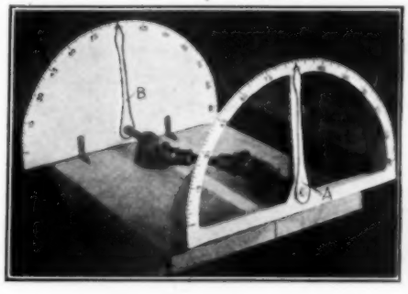


Fig. 12

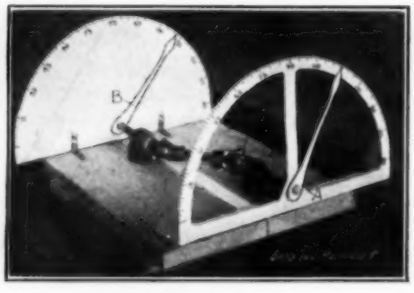


Fig. 13

Rear Pointer Catching Up To and Passing Front Pointer

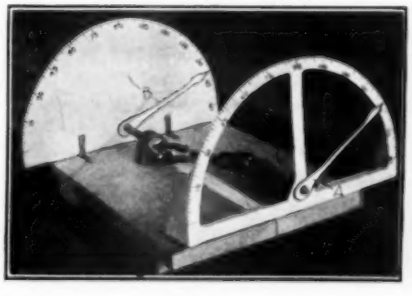


Fig. 14

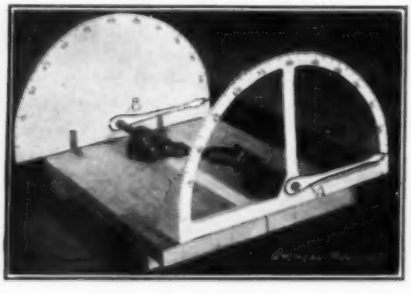


Fig. 15

Coming Back to Agreement Again at 180 Degrees

Other positions could be shown, but Figs. 3, 4 and 5 show why the motion is irregular and the reader may carry it as far as he desires. It should be clearly understood that length of link *X Y* does not vary, as may be seen by Fig. 1, where, of course, the cross arms *K*, that join the yokes *B* and *D*, are in one rigid casting.

As already pointed out, the cure of this irregularity of motion is always to use two joints as in Fig. 1, placing the yokes *A* and *B* on the connecting shaft *H* so that they are parallel. Then, although the motion of *H* will be irregular, the motion of *F* will be a correct reproduction of the motion of *E*. Connector *H* should not be used to carry anything like a flywheel, nor should it be used to impart motion to anything other than shaft *F* (or *E*, for the combination is perfectly reversible) through a second universal joint, as shown.

Shafts Not Necessarily Parallel

As might be supposed, the degree of irregularity of motion of a universal joint depends upon the angle between the shafts and this was shown in a table in Mr. Stoddard's article previously mentioned. It might be well, also, to call attention to the fact that shaft *F*, Fig. 1, may lie along line *M N*, making angle θ equal to angle ϕ. When this is the case, so long as shafts *E* and *F* are in the same plane and yokes *A* and *B* are parallel, the motions of *E* and *F* will exactly correspond and the irregularity will be eliminated as before. No arrangement, however, will make the motion of *H* uniform and for this reason, as said, it should be used solely to transmit the motion between the two properly placed universal joints.

Thanks are extended to the Garvin Machine Company, of New York City, for the loan of the joints used in constructing the model.

Producer and Water Gas for Furnaces

By L. B. Lent

The use of producer and water gases for furnace work, with types of burners, furnaces and piping. Records of output and costs indicate that this application of gaseous fuel in shop and factory offers one of the most promising sources of economy in manufacturing processes.

In a previous article, the commercial production of both producer and water gas was treated and it is assumed that the reader is familiar with the nature of both of these gases and with the methods by which they are produced. This article will deal principally with the uses of these gases as fuel.

It was shown that when coal was gasified in a producer, the thermal efficiency of conversion was about 80 per cent. The natural question arising in the minds of many readers might well be, why is it not more economical to supply heat to the furnace by burning coal in the furnace or adjacent thereto, and so save this loss, which accompanies its conversion into gas?

This question brings us naturally to the subject of the advantages of gas-fired furnaces over direct-fired furnaces.

Advantages of Gas Firing

Some of the reasons why gas firing excels direct coal firing are stated well and concisely in a publication of R. D. Wood & Co., of Philadelphia. They are: "First, more complete combustion is secured; second, higher temperatures of combustion are possible; third, there is less loss of heat through the waste products of combustion; fourth, greater efficiency in transfer of heat; fifth, heat may be recovered from hot waste gases and returned to the combustion chamber in preheated air (this is also true of coal-fired furnaces); sixth, gas and air supply and, therefore, combustion, are under easy and complete control; seventh, avoids loss through grates and transport of coal; concentrates and minimizes labor in handling coal and ash; eliminates deleterious effect of ash or extraneous matter on the substances subjected to heat and irregularities of charging in direct firing."

In direct firing, the theoretically correct amount of air necessary for complete combustion is largely exceeded in practice. At least double the theoretical amount and often much more is necessary to even approach complete combustion. This is more pronounced in the burning of soft coal than in hard.

It must be obvious, therefore, that a considerable amount of the heat generated in combustion is absorbed in heating the excess air and this results in lower maximum temperatures and in decreased efficiency. The amount of this decrease depends, of course, on the amount of excess air.

It is difficult to foretell just how much fuel will be required to perform a certain amount of work in a given furnace, except by comparison with the known consumption in a similar furnace under the same or similar conditions, but it has been found in practice that the consumption when the fuel is made into gas is from one-half to one-third as much as when the fuel is fired direct.

The fuel consumption is by no means the only factor to be considered, for the speed of production, so to speak, of a given furnace is an important item, as is also the amount of labor required to operate it and the cost of maintenance.

Quantitative results will be given, from which the reader will be able to judge of the results as applied to his own conditions.

In Europe producer gas has been applied much more generally than in this country, although its application here is increasing very rapidly. We have become familiar with its use in steel mills, and coke-oven plants, but its application is now being rapidly extended to other industries, such as glass furnaces, brick, pottery and terra-cotta kilns, lime and cement kilns, silver-chlorination and ore-roasting furnaces. When properly cleaned, it is used in many low-temperature operations, as laundry irons, soldering machines, japanning ovens and other operations requiring small flame or jet work.

The application of both producer and water gas to such operations as are common to the machine shop and factory requires clean gas in most cases, and in the discussion following, cleaned gas only is understood.

Gas carrying quantities of dust not only tends to stop up the conveying pip-

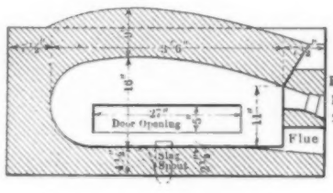


Fig. 1. Cross-section of Large Furnace

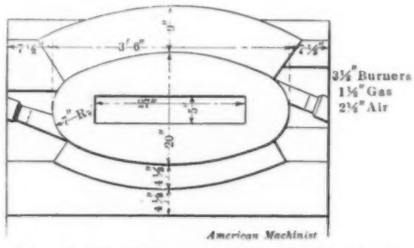


Fig. 2. Contour of Hammer Furnace

ing, but the dust entrained may have a harmful action on the product.

Temperatures

The temperature rise produced by the combustion of producer gas and the proper amount of air will vary with the pressure under which they are delivered and also with the temperature of the gas and air before combustion.

Complete data covering any wide range of varying gas and air pressures and also varying introductory temperatures are not available; at least I do not know of the existence of them. Many results have been noted in actual practice, however, and from these the following results are well established and are very constant for well constructed furnaces.

When producer gas, or the blast gas made in a water-gas plant is burned under 3 inches water pressure with air at the same pressure, the maximum temperature attained is about 1400 degrees Fahrenheit. By increasing the delivery pressure of both air and gas to 10 inches of water pressure, the furnace temperature can be brought up to a maximum of 2300 degrees Fahrenheit.

These temperatures are maximum for empty furnaces. If work is being put into and taken from the furnace, these temperatures will be considerably reduced, in the latter case to about 1900 degrees Fahrenheit.

By increasing delivery pressures, the temperature resulting may be raised, but beyond a certain point this does not pay for the following reasons:

Producer gas is composed of a large percentage of nitrogen and other inert gases; in some cases as much as 66 per cent. of the total volume. It is very evident, therefore, that this inert portion must be heated by the much smaller combustible part of the gas and this absorbs a considerable portion of the total heat generated.

This is not true when water gas is burned; for only 8 to 20 per cent. (depending on the fuel the gas is made from) of the gas is inert and consequently the energy of combustion is nearly all available to raise the temperature of the products of combustion.

Increasing delivery pressures of both air and gas increases combustion temperatures, as previously stated, because it increases the amount of gas burned in a unit of time. But with this increase in the speed and temperature comes a corresponding increase in the volume of the products of combustion and this last increase results in reduced furnace efficiency.

If high temperatures are required, it is therefore better to secure them by the use of water gas than by the use of producer gas at high delivery pressures. This is shown to be so when all costs and efficiencies are considered, including the cost of producing high delivery pressures.

While producer gas requires about an equal amount of air for its complete combustion, water gas requires from 3 to 3½ parts of air to one of gas, and for this reason principally, the air for the combustion of water gas is brought to the burner at considerably higher pressure than is the gas.

When water gas is delivered to the burner at a pressure of three inches of water and the air at 10 inches of water, the temperature reached and maintained in the furnace is from 2600 to 2700 degrees Fahrenheit, with work in the furnace. With the gas delivered at a water pressure of 10 inches and air at about 27 to 30 inches, the resulting temperature reaches a maximum of about 3600 degrees Fahrenheit in an empty furnace and a temperature of 3000 to 3200 degrees Fahrenheit with the furnace working. The temperatures given are those actually observed and measured by a Ferry pyrometer and checked by the use of pyrometric cones.

The flame of burning water gas is almost colorless, but the heat is intense. When a cold steel billet 4x4 inches was inserted into the furnace in which the latter measurements were made, the end was dripping hot in eight minutes. This

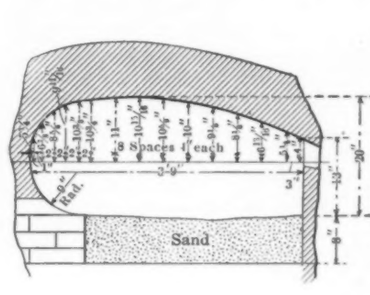


Fig. 3. Contour of Double-chambered Forge Furnace

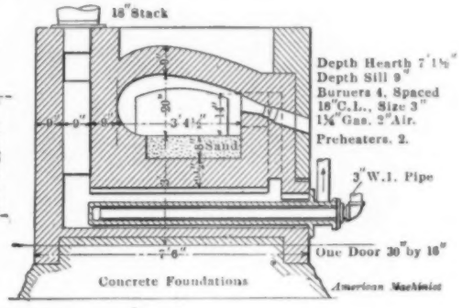


Fig. 4. Recuperative Arch Bar Furnace

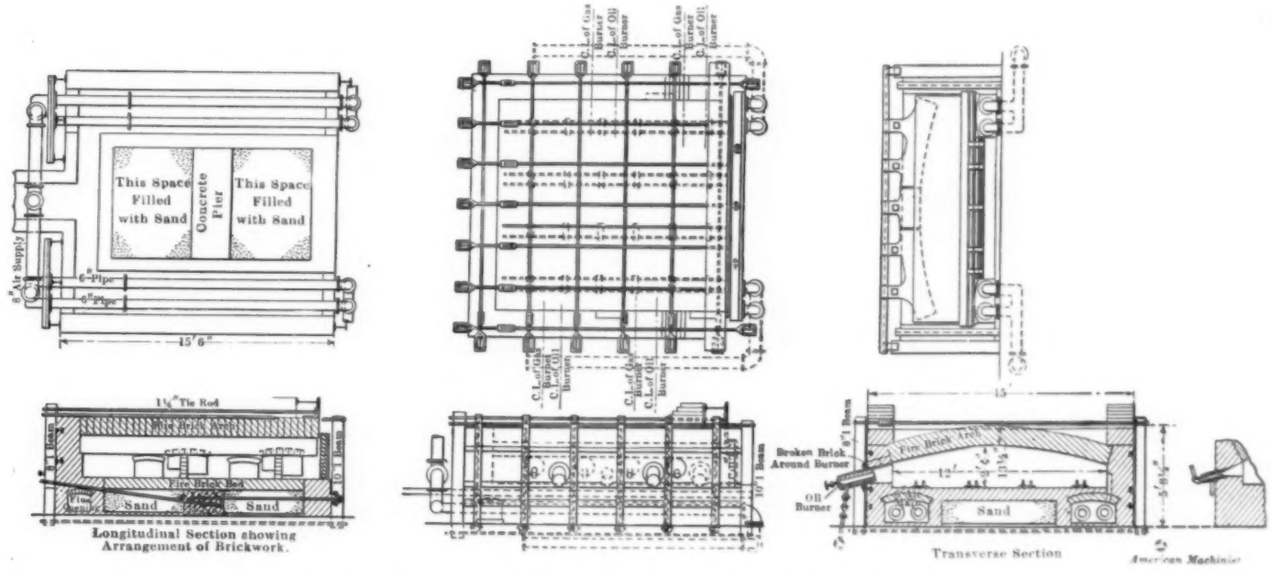


Fig. 5. Forge Furnace Equipped with Both Gas and Oil Burners

may convey a better idea of the temperatures existing than a mere statement in degrees. Almost any temperature up to 3600 degrees Fahrenheit can be produced by burning either producer gas, water gas or a mixture of both.

Recuperation

In a great many furnaces, recuperation is employed to raise the temperature of the air, and will be advantageous in most all cases when the recuperators are properly located. It may seem unnecessary to mention the fact that recuperation should not be so located as to abstract heat from the furnace proper, but this is sometimes done. Waste heat is utilized in several forms of recuperators, some of which are illustrated herewith.

The gain in furnace efficiency when the air is preheated cannot be predicted with accuracy for any particular case, although it can be closely calculated.

The advantage of preheating air for combustion is more pronounced when gas of a low calorific power is burned.

Accurate figures are difficult to obtain, but the following are some of the results obtained in a series of tests made to determine quantitatively this advantage.

The furnace tested was an annealing furnace having a heating chamber 3 feet 8 inches wide, 3 feet high and about 4 feet long. Two gas burners were placed on each opposite side of the furnace and the gas burned in flues under the hearth before passing into the heating chamber.

The preheater consisted of seven sections of 4-inch cast-iron pipe, each sections being in the form of a return bend, each leg of which was about 30 inches long. These sections are supported on a cast-iron base plate, which is protected and baffled with firebrick so as to cause the waste gases to pass through the pipes while air is passed around the outside and also baffled.

The results of one test showed that the gas consumption with preheated air was about 84 per cent. of that when the air was not preheated. The air was heated from 75 degrees Fahrenheit to 463 degrees Fahrenheit and the gas in this case had an average calorific power of 125.6 British thermal units per cubic foot. An average temperature of about 1500 degrees Fahrenheit was maintained as constant as possible.

In another test the heat consumption with preheated air was about 83 per cent. of that when cold air was used.

An average of eight tests on this furnace showed that under conditions which were by no means the most favorable, 29 cubic feet of air per hour per square foot of radiating surface was heated from about 75 degrees to 500 degrees Fahrenheit or a range of 425 degrees. An equivalent recuperation is 220 British thermal unit per hour per square foot of of radiating surface.

One result should be carefully noted, that is, that whereas only about 30,000 British thermal units per hour was recuperated from the waste gases, the constant return of this amount to the furnace in the form of highly heated air results in an increased intensity of combustion and enables the furnace to develop the desired degree of heat with a reduced consumption of gas, amounting to an average of nearly 20 per cent. less than when cold air was used and this corresponds to an average hourly saving of 100,000 British thermal units.

Gas Consumption

It is extremely difficult, if not impossible, to lay down any accurate rules or formulas which will have any general application. For instance, we cannot say that so many cubic feet of gas of a certain calorific power will heat so many cubic inches of steel to a certain temperature in a given time. The shape of the piece is a most important and variable factor; the shape of the furnace also has its effect and many other conditions vary and are seldom exactly alike in any two installations.

It seems almost impossible to give proper expression to the gas consumption incident to doing certain work, except by stating the known consumption in operations under stated conditions and allow the reader to make his own comparisons.

The effect of preheating has been pointed out and the reader must bear in mind that the data given are not all from recent observations, nor do they represent the best results obtainable in all cases. Specific information, which is accurate, is extremely difficult to obtain, principally because the gas consumption of particular furnaces is rarely measured, unless for the purpose of obtaining such information. The following may, however, convey some idea of the consumption of gas in the respective operations enumerated and from these the reader may be able to judge somewhat as to the probable consumption of whatever furnace he has in mind.

A very accurate estimate of consumption may be made if the consumption of coal or oil in any furnace is known. It was pointed out in the previous article that the consumption of coal (gasified) was from one-half to one-third of that when fired direct. The comparative consumption of gas and oil may be figured roughly on a comparative heat unit basis, but the furnace efficiency will be higher with gaseous fuel, as will also be the speed of production.

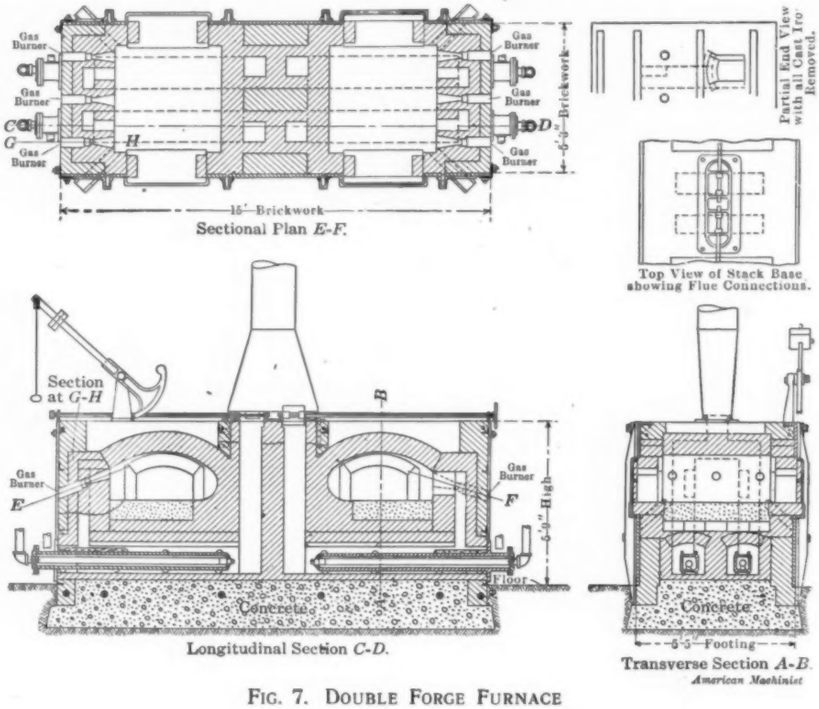


Fig. 7. Double Forge Furnace

The comparative cost of running the furnaces in a large railway repair shop on oil and water gas is given in Table 1. The items show the amount of labor necessary to operate a gas plant of the size indicated and other factors which should be of interest. The cost of making water gas at this plant during a week's run has since been reduced to 4.53 cents per thousand cubic feet.

At this plant the production of the several furnaces has been considerably increased over that which formerly obtained when oil was used as fuel.

The following are quantitative results which show in a measure what may be expected under similar conditions to those under which these results were obtained and may give the reader a sufficient knowledge to guide him in other operations than those enumerated.

In a furnace in which stock for making hammer heads is heated to a forging heat, 4000 pieces are passed through the furnace in a 10-hour day. The gas used is a low-value water gas of about 250 British thermal units per cubic foot calorific power and is delivered to the burner at about 6 inches water pressure, the air being delivered at about 14 inches water pressure.

When this furnace was fired direct with coal, the output was about 278 pieces per hour and twice as many pieces could be placed in the furnace as when water gas was used. The reason for this is that the pieces heat so much faster with gas that the speed is governed by the number which one man and a helper can feed and deliver to the furnace.

At the Ramapo Iron Works at Hillburn, N. Y., in the furnace shown in Fig. 1, 9500 ¾-inch bolts are heated to a welding heat in an 8½-hour run. Water gas of 270 British thermal units value at 6 inches pressure is used and air comes to the burner at one pound pressure. In this furnace, with a hearth 9 inches deep, 2000 1-inch round bolts are raised to a welding heat in an 8-hour day and this number can be increased if necessary. In a furnace of this form having a hearth

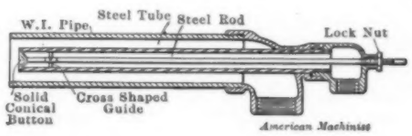


FIG. 6. GAS BURNER

13½ inches deep, 225 bright red heats on 1¼-inch round bars are made in 7 hours and during this period three series of machine dies are run through the furnace as part of the day's production.

The contours of a hammer furnace and a double-chamber forge furnace are shown in Figs. 2 and 3 respectively and in Fig. 4, a cross-section of the general construction of a recuperating arch-bar furnace.

The gas pressure at the furnaces is usually about 4½ inches water and under ordinary conditions the production of these furnaces is about as follows: Arch-bar furnace, 310, 2½x¾-inch by 6-foot bars in 6½ hours; drop-hammer furnace, 300, 2-inch round by 6-inch welding heats in 6 hours; steam-hammer furnace—white heat on 4x4x12-inch stock in 16 minutes; recuperating-forge furnace, 300, 2½x⅝x4-inch welding heats in 6½ hours. Bolt furnace 2000 1-inch round bolts in 8 hours. The water-gas consumption in all these furnaces when running at the above rate is about 33,000 cubic feet per hour.

In an English plant, steel is melted in pots placed in a semi-regenerative furnace, 3 feet wide, about 12 feet long and 3 feet 3 inches deep. Three heats per day are made and about 675 pounds of metal is melted per heat. To do this about 4000 cubic feet of water gas per hour is used.

Examples of specific performances might be given almost indefinitely, but I trust that the reader will have grasped the fact that there are so many variable factors entering into each problem that no rules or formulas can be deduced which can be depended on with any degree of accuracy. The judgment of someone who has had the experience should always be sought in any doubtful case. Two more examples from actual practice will be given to show how the speed of production compares when gas or oil is used; also to show comparative figures for exactly similar conditions when coal and gas are the fuels.

In the first case the same size of iron stock was heated to the same temperatures in the same furnace, which was equipped with both gas and oil burners.

The time in minutes and seconds necessary to bring about the same result in each case, as near as could be measured, was as given in Table 2.

Basis of 3,000 Gallons Oil per Day:		
3,000 gallons oil per day, at 4c. per gallon		$120.00
Compressing air, interest, etc., on plant, per day		7.50
		$127.50
21.45 tons coal at $2 per ton	$42.90	
1 operator at $1.75 per day	1.75	
3 helpers at $1.25 per day	3.75	
15,000 cubic feet water at 20c.	3.00	
10,000 cubic feet water at 20c.	2.00	
Interest, etc	10.20	
Interest, etc	3.12	
Total		66.72
Saving per day		60.78
Saving per annum of 313 days	$19,024	
Cost of water gas per 1,000 cubic feet	5 5/10c.	

TABLE 1. COMPARATIVE OPERATING COST WATER GAS vs. FUEL OIL.
D., L. & W. R. R. Co. SHOPS, SCRANTON, PA.

In two similar furnaces, each 12 feet 6 inches by 10 feet by 9 feet high, cast-iron railway car-axle boxes are heated for annealing. One furnace was fired direct with coal and the other furnace fired with gas made from the same grade of coal. Comparative results extending over a period of time are as follows:

Time required in firing up, coal fired, 17 hours; gas fired, 12 hours. Time required heating charge, coal fired, 40 hours; gas fired, 15½ hours. Fuel cost per charge, coal fired, $29.28; gas fired, $9.35.

FURNACES

It is perhaps safe to say that a system of gas-fired furnaces, properly installed and operated, will prove to be the best of any in the quantity of output. The relative costs of fuels are frequently a deciding factor in a choice of fuels, but it must be borne in mind that most furnaces are equally well adopted to the use of either oil or gaseous fuel and frequently are easily fired direct with coal. Indeed some furnaces are supplied with both oil and gas burners. In one case when changed from oil to gas, the owners were somewhat skeptical and left the oil burners and piping in place and they now serve as an emergency system to the gas.

Such a furnace, equipped with both oil and gas burners, is shown, Fig. 5. The large furnace is used for heating large plates and other heavy steel pieces to a forging heat before they go to the flanging and other machines and hammers. The location of the cast-iron pipe which composes the recuperator or air preheater is clearly shown and the insulation of the chamber in which they are placed should be noticed as in such a position as to not subtract heat from the furnace proper. The oil and gas burners are placed alternately across the furnace front and each burner is easily controlled.

AN EFFICIENT GAS BURNER

The gas burner which has proved most efficient is shown in Fig. 6. It is seen to be very simple and consists essentially of one pipe inside of another; the outer one

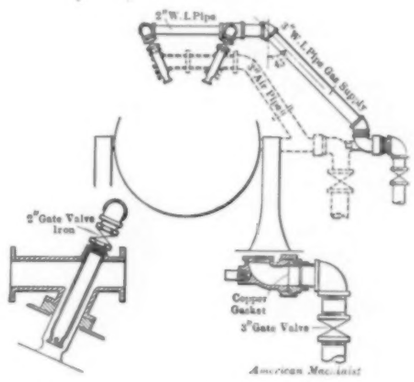


FIG. 8. PIPING FOR SCHWARTZ FURNACE

conveying air being of wrought iron and the inner one conveying the gas of steel tubing. Inside the inner pipe a steel rod is threaded at the rear end and terminates at the forward end in a conical-shaped "button" which serves as a valve disk. A cross fastened to the inner rod just behind the button serves to guide its motion in the inner tube and keep the button central when off its "seat." The exposed end of the rod is squared to receive a handle and the lock nut holds it in any desired position.

A very good mixture of gas and air is possible and with a valve in the air line the mixture can be regulated to a very close degree and first-class combustion obtained. The flame extends to within a short distance of the end of the outer pipe. Such a burner as this is almost universally used and has proved extremely satisfactory.

In Fig. 7 is shown a double forge furnace having recuperators located in the base and having typical furnace contours for good results with water gas.

The similarity to many other types will be at once apparent.

Such furnaces as this one are in constant use giving much satisfaction. The builders of furnaces both large and small are now well acquainted with the requirements of water gas or other gas-fired furnaces and can furnish almost standardized designs for a large variety of purposes.

"Homemade" furnaces are in successful use and producing very good results. Some very simple designs may be worked out and very inexpensive constructions used.

It will be noticed that in all furnaces the shape is such as to cause the flame to whirl around the walls and practically surround the work going through. This has been found to be most efficient; and if a furnace is built having this contour, the burners properly placed, recuperators (if used) properly installed and the furnace strongly built of good refractory material, satisfactory results are pretty sure to follow.

Deterioration

The deterioration of a furnace fired with water gas is at least as small as with any other fuel and in most cases is considerably less. The ability to control and maintain temperatures is largely responsible for this.

Repair and maintenance charges against the furnaces is very small and in one large plant which has used gas-fired furnaces for years, these costs, which are before me, are less than 2 per cent. of the value of the entire equipment, producers, piping and furnaces.

Quality of Product

The quality of the product of a furnace fired with gas is uniformly superior to that from a furnace fired with any other fuel. This is due to the fact that the fuel is cleaner than in any other form and, under no circumstances does it burn with a smoky flame. Nor does the gas contain any chemical constituents which combine harmfully with the product of the furnace.

It is obvious that the supply of gas and air may be so regulated at the burner that an excess or deficiency of oxygen necessary for complete combustion may be obtained at will, and consequently the flame may be made an oxidizing or reducing flame at will. An investigation will show that the products of gas-fired furnaces are actually superior and that is the real proof.

Piping

No special piping is required for conveying producer or water gas made in a set-up which cleans and cools the gas. Hot, raw gas must be conveyed in brick-lined flues, but such gas as we have been discussing can be passed in ordinary cast-iron and wrought-iron pipe and fittings.

The pressures are usually light and where large pipe is necessary, spiral-riveted steel pipe will be found to be very satisfactory and less costly than either cast- or wrought-iron pipe. Where such pipe is exposed to the elements it should be asphalted. Indeed, it is a safe way to put in pipe asphalted, both inside and outside, in any case. If the gas happens to contain sulphur and entrained moisture, the pipe is liable to be attacked and eaten away.

What must be provided for is the ability to clean the piping of an accumulation of fine dust.

It seems almost impossible to clean the gas of all dust, and an extremely fine flocculent ash is carried along, especially if gas is made from anthracite coal.

When the gas velocity is not high, this settles in the bottom of horizontal runs of pipe, but more especially in elbows, tees and sometimes at the burners.

Provision should be made, therefore, for cleaning out the interior of all piping. In place of elbows it is better to use tees and crosses in making up the piping, putting in blank flanges whenever necessary. This allows one or more flanges to be removed and a brush or swab drawn through the piping to remove the accumulated dust. Compressed air or steam is also used to blow any dust out of the piping and if well done is very effective. Steam can very seldom be used to do the work well because its certain condensation will wet down the dust and prevent its release and removal.

	Time in Minutes and Seconds.	
Size of Iron.	Oil Furnace.	Gas Furnace.
¾"x3"	2′ 15″ to 2′ 30″	1′ 32″ to 1′ 50″
¾"x1¼"	1′ 50″ to 2′ 00″	1′ 20″ to 1′ 28″
¾" round	1′ 20″ to 1′ 30″	0′ 55″ to 1′ 5″

TABLE 2. HEATING TIMES WITH OIL AND GAS FURNACES.

In all long runs of pipe, allowance for expansion should, of course, be made, especially if temperature changes are liable to occur. Slip joints are frequently used and long radius bends and loops are found in lines of the smaller pipe sizes.

Wrought-iron pipe is commonly used to convey gas from headers to individual furnaces and the joints are best made up with white lead when screwed and with red-lead putty when flanged. Gaskets are not as satisfactory as the red-lead putty.

Piping to Schwartz Furnace

A method of arranging the piping to a Schwartz furnace is shown in Fig. 8. The result to be accomplished is to provide a controlled supply of both gas and air to the burners and still allow the furnace to be tilted and emptied. The way in which this is done is apparent and requires no explanation.

It would be almost impossible to say definitely when it is best to use water gas and when to use producer gas in many low-temperature operations, in which the latter is permissible.

It is probably safe to say that in all operations requiring temperatures not exceeding 1400 to 1500 degrees Fahrenheit, producer gas will prove a most economical fuel and in all ways almost ideal. It is the cheapest form of gaseous fuel possible to make from coal and its application to the arts is growing at a tremendous rate.

Utilization of Producer Gas to Various Industries

The Winchester Repeating Arms Company has been using producer gas, water gas and a mixture of both for a number of years in about every place where fuel is needed, such as in welding, forging, hardening and annealing furnaces, for heating copper sheets, annealing copper shells after they are drawn, etc. They have a water-gas plant and develop most of their power in gas engines, which consume the blast or producer gas. Indeed, such a method of utilizing the blast gas is ideal when there is a demand for power. Under the high compression existing in the gas engine, the low-value gas is excellent fuel and this utilization of what is sometimes waste gas makes the cost of fuel and power together about as low as it is possible to get it. Since the development of the large gas engine, such combinations are getting common.

The use of gaseous fuel made in one's own factory or shop is extending to about every conceivable purpose. Even the heating and blocking of fur hats is done with producer gas and the singeing of cloth with water gas has been done in a Rhode Island factory for years.

It is my belief that the generation and application of gaseous fuel in the shop and factory offers one of the most attractive and promising sources of economy to be found.

According to the *Electrical World* the energy from Niagara Falls, including operation on both sides of the Falls, is used at the rate of 126,000 horsepower for electro-chemical process; 56,200 horsepower for railway service; 36,400 horsepower for lighting, and 54,540 horsepower for various industrial services; the total being 273,140 horsepower. Since the water of Niagara Falls represents probably 5,000,000 horsepower it would seem that only about 5.5 per cent. of the available power is being utilized at present. From the figures herewith presented it would seem that the agitation growing out of the belief that Niagara Falls will be ruined seems somewhat unfounded.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

Two Special Machines Used in a Grinding Wheel Factory

In addition to building several types of grinding machines, the Springfield Manufacturing Company, Bridgeport, Conn., makes grinding wheels of all sizes, grains and mixtures of adamite, corundum and emery for both wet and dry grinding and it is only natural to find a number of specially built machines used in their wheel department.

Two of these special machines are shown in the accompanying halftone, Fig. 1 being a double-end lathe used for boring and turning large grinding wheels, the ones shown having an outside diameter of 36 inches. The left-hand view on this cut shows the grinding wheel placed in a four-jawed independent chuck, in which it is held while the inside is bored out with a diamond and one side turned.

After being bored out, the wheel is transferred to the inside chuck, as shown on the right, and the other side and the periphery trued up, using a tool with a hollow, saucer-like cutter on the end. This cutter is free to revolve as the wheel turns and throws off the abrasive after the manner of the ordinary dresser. One of these saucer-shaped cutters is shown on the tool carriage at *A*.

Not only is the testing of the cutting properties of their own wheels important, but it is also desirable to compare them with those of other makes, and for this purpose the machine shown in Fig. 2 has been designed and built.

As the halftone shows, the machine is essentially an ordinary square-base grinder to which have been fitted carriages operated by weights which are equal for each carriage and which feed the metal to be ground against the wheels. The dogs on the side of the carriages may be thrown up out of the way or used as distance gages during the test. With this machine reliable tests of different wheels on all classes of metal at various speeds may be easily obtained, and enables the company to make wheels that will meet specific demands from their customers.

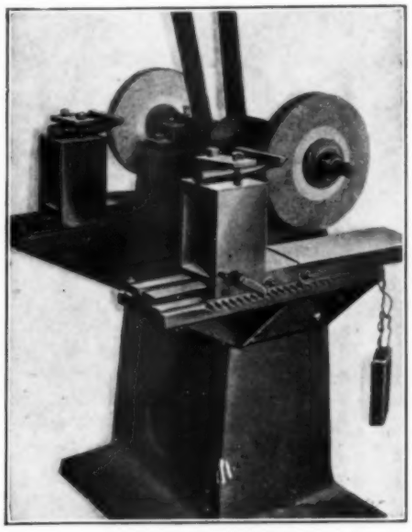


FIG. 2. MACHINE FOR COMPARING THE GRINDING EFFICIENCY OF TWO WHEELS

New York. E. V.

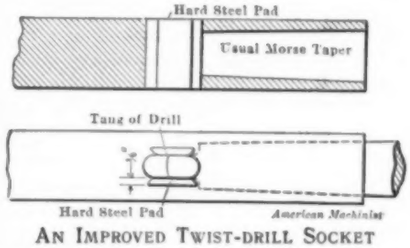
An Improved Drill Socket

The number of tangless twist drills is prodigious; and many and ingenious are the methods which have been devised for using up such drills.

I write of a method which prevents the breaking off of the tangs.

The Morse socket-and-twist drill as a combination, *if properly fitted* leaves nothing to be desired; but, the fitting of the tang part of the socket is not always right. The result is broken tangs. Here is my remedy.

The trouble having been caused through the flats in the socket being either out of place or badly worn by use, the introduction of hand steel, dovetailed pads, at the part of the socket where the defect usually occurs, is a positive and inexpensive preventative.



AN IMPROVED TWIST-DRILL SOCKET

And in the event of any ultimate wear of these, the pads may be made to standard sizes, stocked and fitted to the defective drill sockets, in the tool room. The device has proved itself of value and has added considerably to the all-round utility of the Morse drill socket.

London, Eng. J. T. TOWLSON.

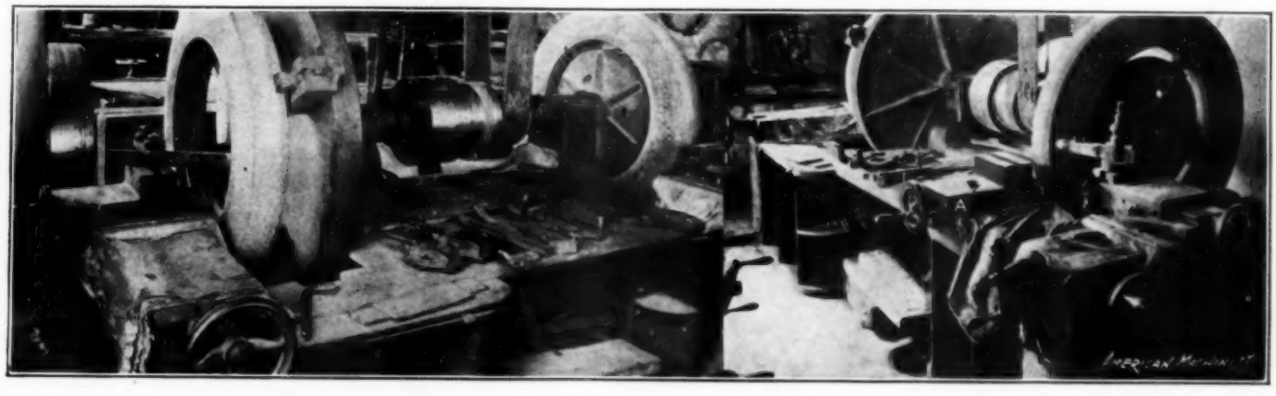
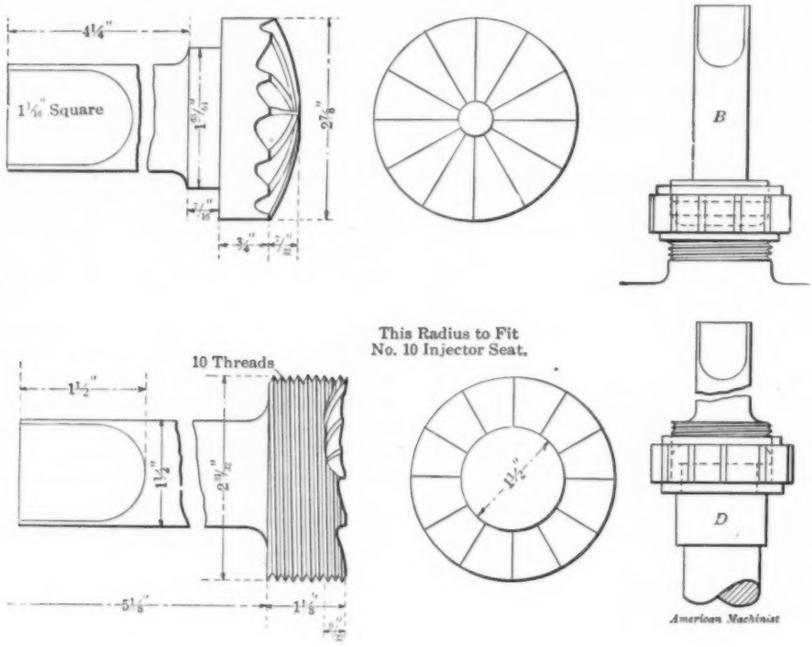


FIG. 1. DOUBLE-END LATHE FOR BORING AND TURNING LARGE GRINDING WHEELS

Reamers for Injectors and Boiler Check Connections

The accompanying cut shows two very handy labor-saving tools for facing the ball-joint unions, where pipes connect to injectors. With these tools the seats may be faced without removing the injectors or pipes from the engines.

Tool *A* has a ball-fluted face and when in use is held in place by the injector nut, as shown at *B*.



REAMERS FOR INJECTOR AND BOILER-CHECK CONNECTIONS

Tool *C* is hollow-fluted to match tool *A*, and is held in place on the injector-pipe brass sleeve, as shown at *D*.

With either tool a few turns with a wrench faces off the seat smoothly and quickly.

Charles Markel,
Shop Foreman, C. & N. W. R. R.
Clinton, Iowa.

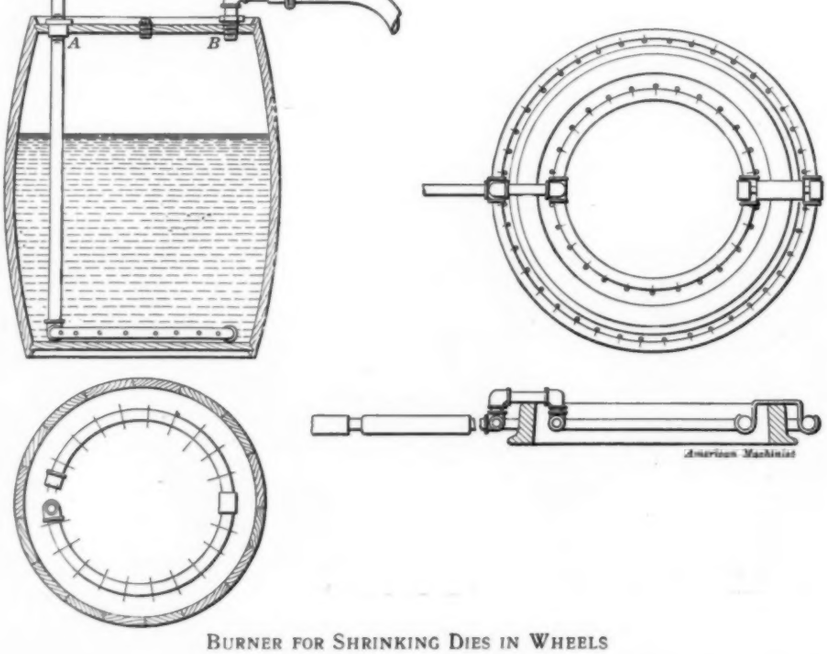
Burner for Shrinking Tires on Wheels

The burner uses vaporized gasolene. An oil barrel is partly filled with the liquid gasolene and a pipe is run from the air compressor into the barrel, as shown at *A* in the line cut. A coil, in two pieces, is fastened to the end of the pipe and located in the bottom of the barrel. This is perforated with small holes, through which air is blown. When the air goes into the barrel it bubbles up through the gasolene and vaporizes a part of it; which goes through the outlet pipe *B* to the burners.

The burner is made in two coils; one of which goes inside of the tire and the other outside, as shown by the two views at the right of the cut. A pipe with a leather-covered asbestos grip is screwed into it to serve for a handle. This burner is placed over the tire as shown, or with tire reversed. By placing a sheet-iron plate over the top it will greatly increase its heating capacity.

With this burner one mechanic and three helpers were kept busy all the time.

Brooklyn, N. Y. C. W. RICHARDS.



BURNER FOR SHRINKING DIES IN WHEELS

Measuring a Small Nut Thread

Since we in Germany are so unfortunate as very often to work with bastard threads, the toolmaker in screw factories and turret-lathe shops meets with a great deal of difficulty in laying out threads of small diameter nuts to agree with the standards furnished. A very sure and simple method is as follows: The piece to be measured is first washed clean in benzine, and then the thread is well blackened with soot from an oil lamp. Then it is warmed on a heating or tempering plate, and the inside is cast full of bearing metal, it being allowed to remain on the hot plate so as to keep the metal fluid as long as possible. Before it cools, a piece of wire with flattened end, or something similar, must be stuck into it. This will be something to take hold of for screwing out the casting after it has cooled. By this method is obtained an accurate counterpart copy of the unknown nut thread, which serves very well for making taps.

FRANKFURTER.

A recent visitor from the Argentine Republic pointed out the fact that lack of shipping facilities was not the only barrier to be overcome in securing trade with that country. The main trouble in this case was plain pig-headedness on the part of the manufacturer who absolutely refused to pack his articles in cases of 10 instead of 12, as he did here. It may seem a trifling thing to refuse fu- they order for, but the customer had evidently learned to know what he wanted, and to insist on getting it.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Loyalty

Your editorial, "Loyalty," at page 35, and the comments which have since appeared, interested me greatly because I have recently had to suffer from lack of loyalty in a slightly different way. This is the case of a subordinate who wanted to be loyal, in fact was so anxious to be loyal that he disobeyed orders when he thought it was for my best interest to do so, and erred in judgment in so doing. The particular thing was that I was accessible all the time and he was simply doing what he did to gain credit, not with me, but with the men higher up. Now it may seem harsh, but what can be done with such a case if persisted in but let the man go? That is a form of loyalty that is certainly reprehensible.

When the owners of a concern hire a superintendent they hire him, not merely to execute their orders, but to initiate and to originate ways of doing things. When a subordinate tries to ingratiate himself with the owners by deliberately changing the design of tools furnished him by the superintendent, without the latter's knowledge, he surely is loyal to the wrong man if he is loyal at all.

M. C. Jackson, page 316, seems to have played in hard luck. In the first place does the fact that one does not respect an employer or a foreman render it necessary to be disloyal? I do not believe that it does. It may be disagreeable, but it is not impossible. Again the fact that he was cheated in his second position is not an argument for or against his staying in the first place. If we could all look into the future we very likely would sit down and die rather than go ahead.

W. F. Helmond, page 363, seems to have confused the meaning of the word "loyalty" with "fair play." Loyalty goes beyond the exact balancing of right against right. A workman may do all his work exactly right and not be loyal. A firm may pay all its men exactly as it agrees and not be loyal to them. The employee who is loyal goes more than half way in his relations with his employer. He does it for one of two reasons, one because he thinks it pays, the other because he is in some way impelled by the belief that as a part of society it is his duty. Impelled by loyalty he comes down to the shop on Sunday to see that everything is right to start up Monday morning. Impelled by loyalty he investigates when a tool seems to be running wrong even though his duties do not include it.

On the other hand an employer who pays his men exactly according to the time clock is fair, but if he looks up his men when they are at home sick or helps them when they are broke, that is loyalty. With all respect for Mr. Helmond's feelings and those of hundreds who feel the same way, I wish to say that I believe there is actually as much loyalty in one direction as the other; that is, if a man is a man it makes no difference whether he is an employer or an employee, it is bound to show.

Springfield, Mass. ENTROPY.

Graduating a Scale

In reply to criticism by G. W. A. on page 365, of my article "Graduating a Scale on a Milling Machine," it is evident that G. W. A. is not quite as familiar with the uses of dividing heads on universal milling machines as his criticism would make one believe. I am going to point out just why I insisted on using the back-stop pin in making each move or graduation.

The index-crank handle could not be used. If I did use the index-crank handle I would simply revolve the spindle of the dividing head just the same as if I had a case of simple indexing to perform, assuming that the work was held in between the centers, and in doing this it can be readily seen that the screw would not advance the table of the machine the amount desired. Thus it is necessary to resort to using the back-stop pin to make indexings.

By leaving the crank handle in any hole on any circle of the index plate, it follows that the index plate and index-crank handle both move in the same direction, which must advance the table of the machine the required amount.

Now a word as to the index plate "running out," which G. W. A. states, would cause inaccuracies in the indexings. While nothing is perfect and while there is likely to be a slight inaccuracy in the index plate, it is so very slight that I believe it would be hard to locate even with a magnifying glass.

EDWARD J. RANTSCH.

Brooklyn, N. Y.

Trade Opportunities in Russia and Their Possibilities

The other day my attention was attracted by an article of K. F. Van Bamgar on page 172, as it contained some valuable information about Russia and its commercialism. He talks about trade opportunities in Russia but gives the impression that Russia as a market, is practically closed to everyone else except the Germans, because they are the only people who know how to do business with the Russians.

English firms have long known Russia as a good market, many English managers have found it equally rosy from a monetary point of view. Hundreds of Englishmen have held and do hold today good positions in the cotton mills of Russia, as spinning managers, weaving managers, chief mechanics, engineers, managing directors, etc. I visited a big machine-tool works in Petersburg quite recently and found that nearly all their equipment had come from England. This particular works supplied the Russian admiralty shops with machine tools. Its managers, draftsmen, etc., were all English and Scotch. England has long been the leading factor in Russian business circles, ever since Russia began to know what industrialism was. That the Germans are pushing their way into Russian markets I quite admit. I was at a mill near Moscow a little over a year ago and there I found that they had taken out the English-made engines of the Corliss type and supplanted them with steam turbines and an electrical system of driving throughout, all of which was supplied by a German firm. I have since been informed, however, that the result did not justify the change.

I would not imply that English firms have done all that is to be done in Russia. Russia is a market of unlimited possibilities, and it rests with the manufacturers, to whatever country they belong, to prove to the Russians that they have something to offer which it will be to their benefit to buy.

The need for industrialism is becoming more and more realized in Russia every year. The vast tracts of undeveloped land throughout Russian territory both in Europe and in Asia; the immense sources of untouched minerals that abound throughout the Empire; and the millions of its population are sure evidences of a busy future. The business men of other countries are the ones who alone can hurry it on. JOHN ROLLINSON.

Padiham, England.

Removing Blots from Tracing Cloth

On page 71, a writer states that spirits of camphor will remove ink from tracing cloth without damaging the cloth.

I immediately tried a standard strength solution and also solutions of increasing strength up to one that would remain liquid only when slightly warm, but with little success in taking off ink, though the cloth has shown no sign of damage in the two weeks that have elapsed since I finished the experiment.

Possibly it will take off some kinds of ink. All that I tried was the standard, waterproof black, because that is the only kind I use. I tried both sides of the cloth with no difference in results.

A Pittsburg engineering-supply house makes a revolving circular eraser driven by a flexible shaft from a desk-fan electric motor (the shaft replacing the fan) that is a great labor saver. It takes some care to avoid stretching the tracing or rubbing holes in it, but it takes off the ink marks.

Scottdale, Penn. B. D. BUFFUM.

Burning Water(?)—A Little Chemistry

Judging from the article appearing on page 775, Volume 33, Part 2, I think there seems to be no very clear idea in the mind of the writer as to what is meant by combustion or burning. It is simply the rapid chemical union of a substance with oxygen, heat being generated by the process.

The substances in ordinary gas which burn are hydrogen and various other gases consisting of hydrogen and carbon in different proportions. The carbon with oxygen produces carbon dioxide (CO_2), while the hydrogen with oxygen produces water or steam (H_2O).

Now, even if the steam were decomposed into hydrogen and oxygen (which it is not), all these gases could do would be to unite together again without in any way affecting the action of the other gases.

If the hydrogen from the water mixed with the city gas, it would be of no use without oxygen, and in burning it gives up no more heat than was originally supplied to the steam in order to decompose it.

Ordinarily, the oxygen required from combustion is taken from the air, which is simply oxygen diluted with about four times its volume of nitrogen. The nitrogen takes no part in the chemical action; but simply passes through the burner, and a good deal of heat is wasted in heating up this large volume of gas as it passes through. It is for this reason that the oxyhydrogen and oxyacetylene torches are so much hotter than those using air; the oxygen is practically pure without all the nitrogen in the way.

But it doesn't use equal volumes of oxygen and hydrogen. These two gases unite in a definite proportion; two of hydrogen to one of oxygen by volume. If more oxygen is supplied it is wasted, but frequently a little extra oxygen is admitted to make sure that all the hydrogen is burned.

I trust that this will make things a little clearer, but there still remains the original question: "What is the steam for?" in default of any other explanation, I am inclined to agree with Mr. Snook, that it serves merely to produce a good draft; on the same principle as forced draft under a boiler.

London, England. FERNO.

Drilling Cast Iron

On page 315 of AMERICAN MACHINIST is an article; "Drilling with a Two-man Machine."

The article states in substance that 91 one-inch holes were drilled through cast iron approximately 1¾ inches thick in 27 minutes. The holes in question were drilled in a tank about 9 or 10 feet in diameter. Thus it will be noted that the holes were drilled at the rate of about 18 seconds per hole.

Presuming this tank was round and only one foot high and of average thickness, it would weigh at least about three tons. It will thus be noticed that the drilling was very interesting even if it was being done as a test, as no time is taken into account of withdrawing the drill and moving to the next hole nor the moving of the work into three different positions as the writer states. It would be doubly interesting if the writer would let us know the speed of the drill he was running, also the make of the radial drill and whether he had any cooling or lubricating liquid on the drill while doing this job. To offer a comparison with this job it might be remarked that a one-inch drill running at a peripheral speed of 35 feet per minute or approximately 134 revolutions per minute and with a feed of 0.015 inch per revolution, would take 116 revolutions to go down 1¾ inches or practically 52 seconds per hole.

Again take a drill running 80 revolutions per minute and a feed of 1 inch per minute which is considered a fair rate to travel. It would take practically 1¾ minutes to drill the 1¾ inches in depth.

While the statement is not discredited it would certainly carry more weight with a little more facts given.

Newburgh, N. Y. GEO. H. HANDLEY.

A Speed Tag

In reference to the article under this heading, published at page 249, we are informed by the Seneca Falls Manufacturing Company, Seneca Falls, N. Y., that they have been using on their quick-change feed lathe an index plate exactly on the lines shown in the article mentioned.

Right or Left Hand Spirals on End Mills

The article on page 292, on the cutting of end mills proved very interesting, and goes to show the differences of opinion which men who are equally good mechanics will have on the same subject.

In general practice it has always seemed best to use an end mill with the spiral the same hand as the cut, i.e., a right-hand spiral on a right-hand end mill, and a rather steep angle of spiral if the cutter is to be used for face milling. This is especially true on large shell end mills.

For rapid work much better results can be obtained by making a machine-steel adapter to screw on the nose of the spindle, and the outer end made like a standard shell end mill arbor, it being obvious that a right-hand mill should be used on a milling machine having a right-hand thread, and *vice versa*.

This overcomes entirely the objection raised of the tendency to pull the cutter out of the spindle, and it carries the end mill much more rigidly than a taper-shank arbor could ever do. Of course, this would apply to shell end mills only.

On a facing cutter, the general commercial practice is to cut the teeth straight for center. If the tooth is quite a distance back of center, it always seems to give a much easier cut.

It is true that the reverse angle of spiral leaves a stronger tooth, but it is also true that it needs to be stronger, as it takes more power to run it.

If the tapers fit and are properly cleaned, and put in tight, they will generally stay. Use the pull rod if you have it, but put them in tight enough so they would stay without it.

Detroit, Mich. W. E. WILBER.

Can Forgings be Graded by the Grain

I hardly think Mr. Osborne will gain much by trying to control the manufacture of crang-shaft forgings by means of fractures as stated in his article on page 31, It is, of course, almost impossible to prevent the overheating of steel, or the cold working of steel, both of which are liable to cause bad results, and I think that by far the best way is to adopt some heat treatment which will get rid of these bad features after the forging is made.

I know one firm which buys hundreds of crank-shaft forgings during the year, and they specify the analysis of the material they require, and every forging has to be oil dipped by the manufacturer.

In forging crank shafts it is impossible to put as much work on the parts near the webs as on the straight shaft itself and therefore it is not to be expected that the test results from these parts should be equal to those from the shaft.

Prejudice is dying hard with regard to

oil treating, but I offer it to Mr. Osborne as a solution of his broken crank-shaft problem. Fractures are so variable even from the same bar or forging, and even if a coarse fracture is shown at the end of a bar, it does not follow at all that the rest of the bar is the same. If the structure shows signs of overheating the simple process of reheating to about 1600 degrees Fahrenheit and cooling in air will put it right.

Sheffield, England. CONAM.

Tool Steel Economy

I was very much interested in the article "Tool Steel Economy," by L. E. Dickinson which appeared on page 74, Volume 34. The methods he names of using up their scrap high-speed tool steel are very useful and I should like to mention that in the shop where I am employed we use large amounts of this steel, and as some of our large lathe and planer tools weigh over 30 pounds, it will be seen that the cost of steel alone is no little item. We have recently been using up some of our old cast-steel shanks and on the ends of these we have brazed a short piece of self-hardening steel about 3 to 5 ounces in weight. The time taken to do the job was about one hour and after testing them under a severe cut, we found that they stood up just as well as the solid tools. As there is a saving of over 50 per cent. on the cast steel, and the time taken to braze on the tool nose is so little, I think it will be very plain that there is a great saving in making tools of this description.

I may add that these short pieces were made from tools which had become short from grinding, and after the tool shank has once been prepared, a fresh piece of steel can be brazed on in about 15 minutes.

Leeds, England. TOM JONES.

Small Set of Swedish Gages

The set of Swedish gages shown in the AMERICAN MACHINIST, page 324, does not seem to contain the proper blocks to get the greatest number of different values with a set containing only seven blocks. As shown, all exact sizes may be obtained from 1/16 to 1 13/16, varying by sixteenths; also, all sizes from 1/16 to 1¼ may be obtained either 0.001 under or over size. But by making the largest block in the set, 1 inch instead of ¾ inch, then four additional exact sizes may be obtained, and also four more under and over sizes, the exact sizes then running up to 2 1/16, and the under and over sizes each to 2 inches.

In any series of size blocks, in order to get the greatest number of different sizes in a series of equal steps, with a minimum number of blocks, each block has to be twice the size of the one next preceding it in the series; that is, if the individual size blocks form a geometrical series with a ratio of 2, then the sizes obtained by combinations and single blocks will form an arithmetical series with a common difference equal to the smallest single block. This law seems to have been appreciated in making the smaller blocks, but why it should have been ignored in the case of the largest block of the set is somewhat of a puzzle.

In designing a set of blocks in the way here advocated, there will be no duplicate sizes (if the over and under sizes are omitted), but this disadvantage, if it is such, is more than offset by the increased range of sizes obtainable, and it may be possible that the larger sets of Swedish gages might be redesigned in accordance with this principle, to enable a larger number of different combinations to be obtained with a given number of blocks. If this matter were taken into consideration by the milling-machine makers in designing the spacing washers on their cutter arbors, they would receive the everlasting thanks of many of the men who use their machines.

Brooklyn, N. Y. WALTER GRIBBEN.

Driving Drills and Boring Bars

S. H. Cox, in his article under the above heading, has undoubtedly brought up a subject over which not only many drilling-machine manufacturers have been puzzling, but likewise the manufacturer who is using these machines, in his endeavor to push production. The fact that we now have on the market the increased size of shank, the flat and other special driving devices, indicates a desire on the part of manufacturers of these tools to meet satisfactorily a growing demand for better drives.

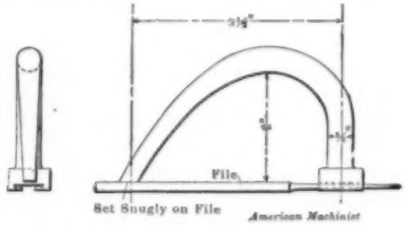
In designing and building some heavy-duty high-speed drilling and boring machines, we have been face to face with this same problem. We have been able so far to solve the drive problem, not only to our own satisfaction, but to the full satisfaction of our customers. Several years ago, in a heavy boring machine, where the duty under high-speed steels working on cast iron was particularly severe, we milled a slot across the end of the spindle, however, making it as wide as the open end of the taper hole. Of course, the spindle was amply heavy so that there was no weakness arising from the wide milled slot. Our main reason for making the wide slot was to decrease the cost of producing the tools which was a heavy item for the customer, and which naturally was of interest to him. Since that time, the machine has been under heavy-duty service, and not once has there been any trouble arising from the drive, although an eighth inch per revolution roughing feed is used. Since that time, we have adopted this form of drive on many other machines and their operation has proved very successful.

It seems to me that since the cost of increasing the size of the spindle nose to a sufficient diameter to provide for a full width slot is so small and comes only once in the life of each machine, that this size slot is the most economical to adopt, because it reduces the cost of manufacture of these tools which would mean a reduction in an expense item. Furthermore, this open-end slot size could be easily standardized, making it more convenient all around.

Freeport, Ill. C. A. HOEFER.

A File Holder for Flat Work

In answer to J. H. R.'s article in the AMERICAN MACHINIST, on page 222, would say that the holder herewith illustrated is cheaper and just as good. This holder was made from an old square-head bolt, with a taper dovetail slot planed and filed as illustrated, the taper being made to fit the taper on the file tang, with a



A FILE HOLDER FOR FLAT WORK

dovetail of about three degrees on the sides. In using the file, the tang is driven into the handle, and the other end is bent to rest snugly on the file.

W. C. BILLINGS.

New Britain, Conn.

Marking Patterns

I notice an article on page 413, Volume 34, by Fred W. McArdle relating to the marking of patterns so that they as well as the castings, can be readily identified. His scheme is O. K., but herewith is shown a name plate that explains itself. These are made on a machine similar to

MARKING PATTERNS

the name-plate vending machines that are in all the penny arcades, or, scattered throughout the city. The scheme is simple enough. The letters indicate the style of the machine, the first set of numbers the identification number, and the last, the pattern or casting number, and read like this: Press No. 21, Part 8. These plates are attached to the patterns representing this part, and invariably come out clear and distinct in the castings.

Brooklyn, N. Y. A. CALDWELL.

Homemade Standard Tools

On page 77, F. B. H. takes Mr. Godfrey to task about homemade tools, and I quite agree that "the buying cheaper notion can be carried too far."

If it be agreed that only such tools as may be considered special shall be made, who will decide what are special?

If the determining factor is to be cheapness without reference to time, then so far as many standard tools are concerned the tool room need not exist except as a distributing and repair center. But in the larger tool rooms there are many factors that must be considered, other than the question of market price of tools, and it will often be found that cost is at most, a secondary consideration.

The principal factor in a tool room is time. This being so, it follows that no tool room is, or can be, as efficient as it should be, unless it can turn out any tool required of it in a shorter time than it could be purchased.

Even if total cost is slightly in excess of the purchasing price, this extra cost must not be put down as dead loss, because it may be that by making them we have been using machines that would otherwise have been idle, and so these machines are enabled to pay for themselves in a shorter time.

Another reason why some, at least, of the so called standard tools should be made is found when we come to analyze repairs. Let us consider a concrete example, and since F. B. H. in his letter quotes the fact that they effected a distinct saving on milling cutters, let us take milling cutters as an example.

These tools can be repaired (recut and hardened) from three to five times, depending on the steel, shop accidents, etc. The introduction of the newer and more expensive high-speed steels makes it imperative that the tool room should be in a position to repair them, that is, remake them, which includes cutting the teeth, gashing in the case of roughing mills, hardening, grinding, etc.

Now it will be seen at once that if we have the plant necessary to do this, then we have all the equipment necessary for making new cutters, and with a staff that are, and intend to keep, in the front of the procession, this side line is a paying proposition, one moreover that presents no difficulties that the ordinary medium size, or even the small tool room, cannot cope with.

What is true of milling cutters is true, in a measure, of many other tools, such as twist drills and taps.

I know an assertion that an ordinary tool room, for instance, can make high-speed drills as cheaply as they can be bought, may be laughed at by the uninitiated, but it is nevertheless a fact that all sizes over ½ inch in diameter can be made without any loss, and sizes over 1 inch in diameter can be made with a good margin of profit. This assumes that the staff is wide awake and is given a free hand to do them and, of course, that they are interested in trying. As F. B. H. puts it, "Discrimination and good judgment are necessary in deciding what shall be homemade."

WALTER G. GROOCOCK.

London, Eng.

The Parting of Patterns

Referring to the article by J. R. D. under the above heading on page 1115, Volume 33, Part 2, I think he must have thought his way was the "correct way" for the patterns to be made, judging by the lecture he gave the patternmaker. I quite agree with him that most patterns have an unnecessary finish imparted to them by most patternmakers, but do not know but what this is a mixed blessing, as the average molder will be more careful of a well finished pattern than one roughly made.

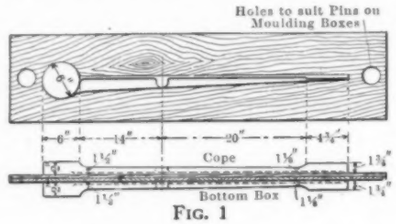


FIG. 1

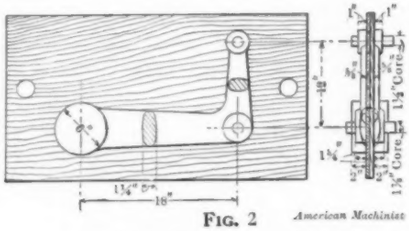


FIG. 2

THE PARTING OF PATTERNS

Coming to the question of split patterns, I think a lot of everyday jobs could be split to advantage and that the two illustrations are cases in point. Fig. 1 is rather a long, slender pattern and I think that if this were made from a solid pattern the molder would have to spend some time bedding it in the sand to get it straight, and when out of use it would be liable to warp, which would have to be rectified in the mold when next used. I think the better way would be to make this pattern split and fix each half on the two sides of a board, which need not be over ¾ inch thick, and preferably made from wood with the grain crossing, which would insure the plate being level no matter how long it was kept before it was again used.

This method of mounting patterns saves a great deal of time in the foundry, as the molder doesn't have to spend a lot of time making joints, as these are made by the board, whereas with a solid pattern the joint making and bedding in must be done by hand, and for small patterns, molders usually have to fill three half boxes with sand, whereas with patterns mounted on boards, the first half box can be rammed up tight at once and it is not necessary to make holes in the pattern for easing and lifting, as the easing can be done by tapping the edges of the board and the pattern lifted with the board. There is no reason why any number of molds should not be made of the two examples illustrated that would not require touching with a trowel, which is more than can be said for the solid pattern.

Fig. 2 lends itself to this method even better than Fig. 1, as owing to the oval section of the arms most of the pattern would be leaving all the time after it was started and the joint would be in a straight line exactly on the center of the casting, whereas if made from a solid pattern the joint would have to be made on an invisible center line and I have knowledge of innumerable cases where this parting line has been anywhere but in the right place.

I have seen patterns mounted in the manner described, castings of which have weighed as much as 10 hundredweight, the sizes of boards being as much as 6 feet long by 4 feet wide, and the castings have been all that could be desired.

F. W. CAMMIDGE.

Halifax, Yorkshire, England.

Automobile Engine Proportions

In the article on "Automobile Engine Proportions" at page 574, Volume 33, Part 2, there has been a mistake made in algebra in deducing the result of a preceding equation.

The formula for b on that page should read:

$$b = \frac{9}{5}(A_{ls} + 0.0703).$$

With reference to the criticism by John Stevenson on page 269 of the current volume, regarding the constants entering into the equations; the critic seems to think the constants are a matter of choice on the part of the writers of the article.

My understanding of the method of determining these constants is that they were measured from average lines drawn through points plotted from dimensions taken from actual engines. If this was the case and correct methods were used in determining the line giving average results, then the constants were determined by the lines so drawn, and were not a matter of selection by the authors. It probably would be interesting to a great many readers, as this is a broad subject, to have the authors give a few of the sheets on which they plotted the practice of builders.

The criticism seems well warranted, as some of the formulas evidently need revision.

WM. L. BENITZ.

Notre Dame, Ind.

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American Machinist

The Lath and Plaster Partition

The latest factory-fire horror in this city has, of course, led to a renewed discussion of our defective methods of building construction, and we wish we had some confidence that it would result in something more than discussion.

There is one feature of our system of building construction that has received almost no attention, and yet it is, we believe, the most important of all from the standpoint of the fire risk. We refer to the customary interior partition made of studding, lath and plaster.

This construction had no part in the fire to which we refer, which occurred in a really fireproof building, the fire being in fact confined to the highly inflammable contents of the building. The lath- and plaster-partition risk is, however, always and everywhere with us, and it has a place in the discussion of the subject which it has not yet found.

A comparison of English and American methods of building construction will make the matter plain. In this comparison we do not refer to thoroughly-fireproof buildings, which are exceptional in England, as they are here, nor to the frame buildings put up without regard to the fire risk, which form so large a portion of our rural and suburban buildings, and which have no counterpart in England. We refer to the great mass of buildings of moderate hight, whether for residence or business purposes, which form the vast majority of buildings in the closely built-up portions of all cities.

One who endeavors to learn by observation the essential difference in the construction of such buildings in England and this country will at first find himself puzzled, if not, indeed, baffled. The walls of English buildings are of brick, while the floors are made of joists and planks, as are our own, and the roof construction does not essentially differ. True, the roofs are better externally, being usually covered with slate or tile, but the interior construction is essentially the same—of rafters covered with boards—and just as vulnerable to interior hazard as our own. Moreover, so far as the trim and other exposed parts are concerned, wood will be found to be used in England with at least as much freedom as at home.

On some occasion, however, the observer will come across a building in which the interior partitions are being put up and he will suddenly see a great light. He will see a thing that he never saw at home—brick partitions between timber floors, brick without exception and without regard to the location or minor use of the partition. Such partitions as have no structural importance are of a thickness that would not be permitted here—the width of a single brick, that is, four inches, which is ample for the purpose.

If the reader will contrast such brick partitions with our construction of lath and plaster, he will see at once the difference between good and bad construction, for the brick partitions insulate each floor from the one above and the one below it. With our construction, on the other hand, every partition supplies a continuous row of combustible flues, connecting the hollow spaces of the floor below with those of the one above it.

Once a fire has reached the interior of such a partition in the basement or on the ground floor, the conditions for its spread throughout the building are perfect. The spread of the fire need not even be progressive from floor to floor, but becomes almost instantaneous throughout the entire building. Had the intention been to devise a plan which would insure the instantaneous spread of fire throughout a building, the prevailing plan could scarcely have been improved. True we have our "fire stops," but what fire did they ever stop?

With fireproof partitions, however, the vertical channels of communication which our plan provides throughout the length and width, the hight and depth of the whole building, are cut off. A fire can only spread by progression from floor to floor, and it can only reach a floor above after it has burned through a floor below.

In attacking the problem of better building construction we have always begun with the floors, whereas in England they began with the partitions. Of course, if an absolutely fireproof construction is aimed at, there is but one conclusion in either case; that is, fireproof floors and fireproof partitions. Absolute and universal fireproof construction is, however, a distant goal, and it is as plain as anything can be that the place to begin is at the partitions.

It is an easy matter to find new buildings in the most densely built portions of this city, of a hight below that for which absolutely fireproof construction is required, in which the interior partitions are of lath and plaster. Moreover, the "semi-fireproof" apartment houses with which the city is flooded, have fireproof floors and roofs, but lath and plaster partitions except around the elevators, stairways and public halls. The men who are responsible for the fire laws, permit-

ting such a construction, deserve not only a leather medal, but a commission compelling them to wear it whenever they appear in public.

If we are to make substantial progress in fire-resisting building construction, the lath and plaster partition must go.

Optics in the Machine Shop

This is a subject that we have touched upon before in these columns, but it is deserving of yet another mention, because of the article appearing in this issue entitled, "Testing Surfaces with a Glass Plate." That article described a very simple, inexpensive method of using the phenomenon of the interference of light in testing the lapped surfaces of size blocks. It is difficult if not impossible to conceive of an easier and more accurate method for making such tests. That the method possesses all the necessary elements of accuracy is shown by the description of the block illustrated, which was made by that process.

This method is nothing more nor less than the simple, practical application of a phenomenon that long remained unsolved. And although the explanation of that phenomenon has been known to physicists for years and the interferometer has become a widely used instrument, this application is its first one that we have met with in producing accurate metal surfaces in the machine shop.

It is worth while to mention another recent article that described the use of a beam of light as an indicator pointer. Its advantages are at once apparent. It is a pointer that can be swung across belts, pulleys or projecting parts of the machine or work, without injury to itself or the parts that it cuts across. It can be made of any length desired; it can be flashed in any direction. It is not subject to any mechanical injury. Here is but another application of a principle of optics.

The use of the microscope in machine shops has been described frequently in our pages, and is another important application of optical principles to the carrying out of machine-shop work.

The most refined measurements or indications made in the world are in the realms of optics and it is probable that there are other methods used by the optical manufacturer, that might have a useful, general machine-shop application. The suggestion in the last part of the first article that we have mentioned seems important. The possibility of a shop instrument that will test size block in terms of fractions of light-wave lengths is alluring.

Obituary

William D. Turner, who has been connected with the Brown & Sharpe Manufacturing Company for some thirty odd years, died at his home in Providence on April second.

Mortimer H. Bickley, president of the Penn Steel Castings and Machine Company, Chester, Penn., died in his eightieth year on April 1, after a lingering illness of six months. He is survived by a widow, two sons and a daughter.

Personals

John D. Riggs has been appointed chief draftsman of the Oliver Chilled Plow Works, South Bend, Indiana.

Andrew C. Campbell who, for the past 16 years has been identified with the E. J. Manville Machine Company as secretary and superintendent, has resigned.

E. A. Moore, formerly with the Bullard Machine Tool Company, has accepted the position of traveling salesman with the Fellows Gear Shaper Company, Springfield, Vt.

W. V. Knauss, treasurer of the Bethlehem Foundry and Machine Company, Bethlehem, Penn., has retired after a business career extending over a period of more than 45 years.

William L. Wilson, who was formerly connected with the Aluminum Company of America, Chicago, Ill., has become vice-president of the Electric Installation Company, Baltimore, Md.

Walter E. Brown, until recently assistant engineer and superintendent of the Penn Motor Car Company, Pittsburg, Penn., has become superintendent of the Middleby Auto Company, Reading, Penn.

Henry Morris, manager and treasurer of the Western Tool and Manufacturing Company, Springfield, Ohio, sailed on April 8 for a trip abroad. He will visit the Turin Exposition, returning through England.

R. F. Pier has resigned his position as foreman of the transformer department of the Canadian General Electric Company, to accept a similar position with the Triumph Electric Company, Cincinnati, Ohio.

A. O. Carpenter has recently joined the drafting department of the Ingersoll-Rand Company, Painted Post, N. Y. He was formerly chief draftsman of the Chicago Pneumatic Tool Company, Franklin, Penn.

S. B. Jackson, who was formerly manager of the plant for the McKinney Manufacturing Company, Pittsburg, Penn., has accepted the position of works manager of the Atlas Tack Company, Fairhaven, Massachusetts.

John R. Ide, until recently in the sales department of the Hyatt Roller Bearing Company, has resigned that position to become associated with the New Departure Manufacturing Company's Western branch at Detroit.

J. F. Nisbet, publicity manager of the Triumph Electric Company, will now also take charge of the publicity and advertising department of the Triumph Ice Machine Company. These two departments have been combined.

Professor W. F. Schaphorst, of the mechanical engineering department of the New Mexico College of Mechanic Arts, has resigned his position there to join the staff of A. Eugene Michel, advertising engineer, New York City.

Waldo G. Gernandt, who was formerly factory engineer with the Rapid Motor Vehicle Company, Pontiac, Mich., has accepted a position with the Packard Motor Car Company, Detroit, Mich., to act in the capacity of designer.

Robert Bosch, of Stuttgart, Germany, inventor of the Bosch magneto, is at present making an extended tour of the United States, on which he is accompanied by Otto Heins, president of the Bosch Magneto Company, New York City.

A. H. Whiteside, who for four years was manager of the power and electrical department of the Allis-Chalmers Company, has withdrawn to accept the position of assistant sales manager of the Triumph Electric Company, Cincinnati, Ohio.

F. Charles Scribner, general foreman of the Wells Brothers Company's gage and tool departments, has severed his connection with this company to become inspector of gages with the Colt's Patent Firearms Manufacturing Company, Hartford, Conn.

G. H. Hannum, formerly general superintendent of factory for the Detroit Lubricator Company, has joined Edward Y. Howell in a general jobbing machine business. The concern will operate under the name of Howell-Hannum Machine Company and will be located at Third and Porter streets, Detroit, Michigan.

A partnership has been formed under the firm name of Foster & Janes, 30 Broadway, Brooklyn, N. Y., who propose to conduct a mill and factory-supply house. C. E. Foster was associated with the Wm. O. Fitch Hardware Company for the past 11 years, as was S. W. Janes for four years.

T. W. Williams, who has for the past 18 years been associated with the General Electric Company, particularly in its gear and pinion department, has become vice-president of the Whipple Supply Company, New York City, and will devote most of his time to the Tool Steel Gear and Pinion Company's output, of which the Whipple company is sole agent.

Shop Equipment News

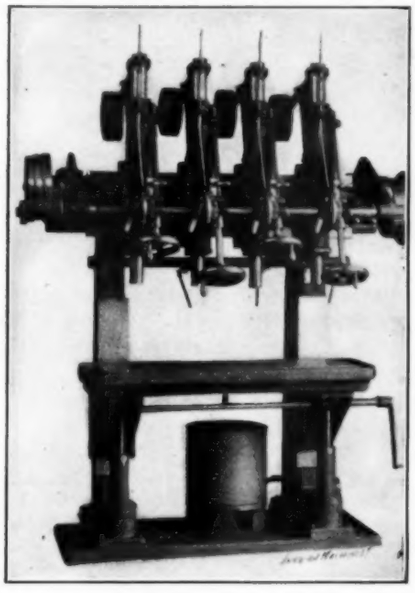
Moline Gang Drill with Independent Spindle Feed

The accompanying halftone shows a gang drill recently built by the Moline Tool Company, Moline, Ill.

The machine is of the independent spindle-feed type and can be equipped with any number of heads desired. It has six changes of speed in geometric progression by 3-step cone and back gear. The drive is similar to that used by the builders in their regular line of machines, which has been previously described.

The spindle feed is by Sellers motion, a bronze spiral working in rack teeth. The bronze spiral mounted on the inclined shaft which also carries the quick traverse handwheel, is driven by bronze and hardened-steel worm gearing. This shaft is pivoted so that the worm wheels may be dropped out of mesh with the worms either by the hand latch or by the automatic stop. The worms are driven by 3-step feed cones through the shaft which extends across the front of the machine. Each worm is connected to this shaft by a clutch which may be thrown in or out by the hand lever shown. On each worm is mounted a hand feed wheel so that when the clutch is thrown out, disconnecting the worm from the shaft, the hand worm feed may be used.

The spindles do not run directly in the heads but in revolving sleeves on which the spindle spirals are mounted.



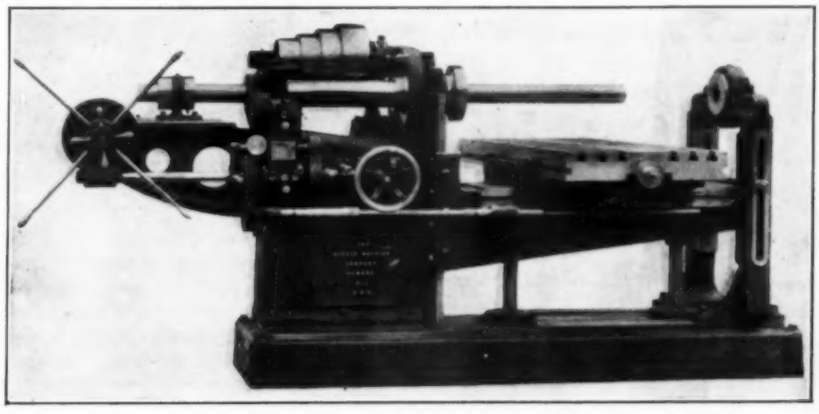
MOLINE GANG DRILL, ADAPTABLE FOR ANY NUMBER OF HEADS

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

Improved Binsse Boring Machine

A new horizontal boring machine made by the Binsse Machine Company, Newark, N. J., for the Emerson Engine Company, Alexandria, Va., has some features that especially adapt it for drilling, boring, reaming or facing work on aëroplane or automobile-engine castings. The machine has a 24x60-inch table; 3-inch boring bar with a 24-inch feed without resetting; reversible power cross feed for the carriage, with a range of 36 inches; takes up 5x12 feet of floor space and weighs 6500 pounds.

The saddle that supports the carriage is gibbed to the table from the sides and not held by bolts and tongues in the T-slots, as frequently done, which makes the table stronger and less apt to vibrate under a heavy cut. The outer boring-bar bearing and table support is so made that it may be brought in close to the carriage, giving additional steadiness. The working parts, operating wheels and levers of the head, are all easily reached by the operator and are practically the same as those of former models.



IMPROVED BINSSE HORIZONTAL BORING MACHINE

Magnetic Switch

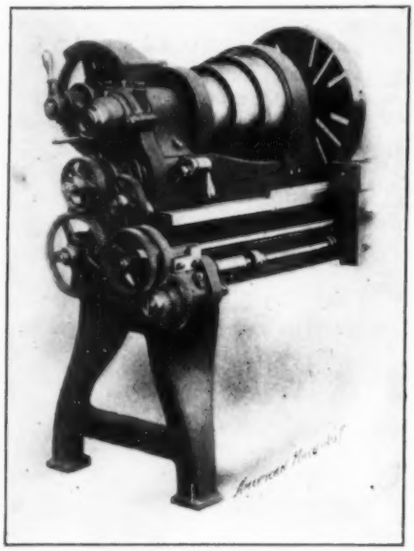
A magnetic switch new in principle and operation has been developed by the Electric Controller and Manufacturing Company, Cleveland, Ohio. This switch has an operating coil which is connected in series with the motor to be started, this coil being composed of a few turns of heavy wire of fire-proof insulation. The switch automatically closes its contacts only when the motor current is below a predetermined value. It is in other words a combined magnetic switch and current limiting relay. If the motor current flowing through this switch exceeds a predetermined value this switch will lock out and will not close until the current has been reduced by the speeding up of the motor.

It will be apparent that this switch (termed the type A switch) is suitable for motor starters, and the Electric Controller and Manufacturing Company has developed a line of motor starters embodying the use of this switch. This form of automatic motor starter provides no-voltage protection, for if the voltage fails, all of the switches at once drop out, inserting all of the starting resistance in series with the motor and upon the return of voltage the motor is automatically accelerated in the normal method.

Heavy Engine Lathe Gear Train

The halftone herewith illustrates the gear train used on a new 18-inch heavy pattern engine lathe.

It will be noted that the train of gears for feed purposes is separate, so that

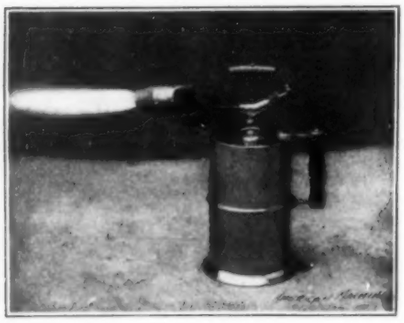


HEAVY ENGINE LATHE GEAR TRAIN

the feed is entirely independent of screw cutting. It will be readily noted that the change gears can also be used for feed purposes. This new feature in the gear train is now being placed on the line of lathes manufactured by the Bradford Machine Tool Company, Cincinnati, O.

Hauck Kerosene Torch

The illustration herewith shows a type of kerosene torch made by the Hauck Manufacturing Company, 140 Livingston



HAUCK KEROSENE TORCH

street, Brooklyn, N. Y., in a large variety of sizes.

They use kerosene as a fuel, for which economy and safety are claimed, and the torch is adaptable for numerous heating operations, light brazing, tinning, etc. The flame produced by this torch is intensely clear, and the use of kerosene in this connection is based on the fact that there are 22,820 more British thermal units in a gallon of it than in the same amount of gasolene.

The torch is constructed so that the tank will remain cool while the burner is in operation. The flame of this torch melts a piece of copper ½x¼ inch in three minutes and 1-inch brass rod in two minutes.

A German Steam Hammer

The accompanying line cuts show a section and side view of a steam hammer by the Anhalter Hufeisenfabrik, Anhalt, Germany. Steam is admitted at the top of the valve and regulated by a cock *z* operated by the hand lever *x*. When the blow has been delivered, the valve *k* slides down and the steam can pass through channel *g* and lift the piston *c*, and the hammer. The valve *f* permits the air above the piston *c* to escape. At the end of the upward motion the valve *k* slides upward, shuts off the steam and permits the steam beneath the piston *c* to flow through the channels *g* and *h*, and the hammer is thrown down. The area of the hammer piston *a* is greater than the area of the piston *c*, hence the pressure on *a* is greater than under *c*. At the end of the stroke the steam escapes through the slots *i* and pipe *l*. A safety valve *b* is connected with the cylinder of the piston *a* by the channels *h* and *i*. This design does away with the shaft of comparatively small diameter, which usually connects the piston with the hammer and so often causes breakdowns and leakages.

The valve *k* can be operated by hand by means of lever *A* attached at one end to the hammer and fulcrums at the other end on a pin in the body of the hammer. This lever *n* oscillates a cam *s* by striking against the lugs *o* and *p*.

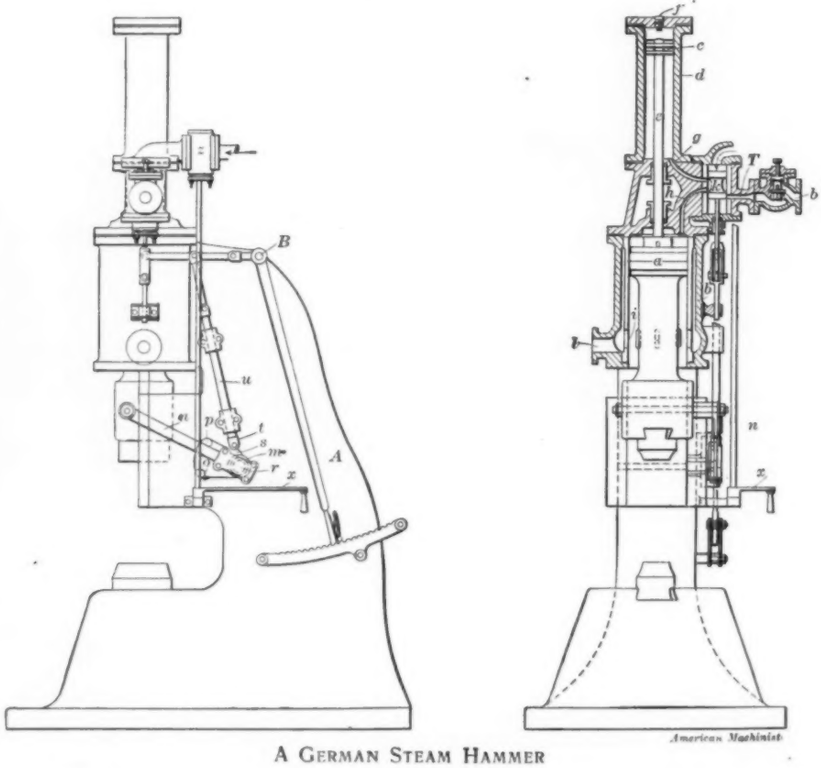
The roller *t* on the end of the rod *u*, always rests on the cam on account of the steam pressure on the valve *k*, and lifts the rod *u*, and consequently the valve *k*. The length of the stroke is altered by lever *A*, which swings on the pivot *B*, and by means of the connecting levers controls the position of *k*; that is to say, if *k* in its lowest position would just open the channel *g*, the cam *s* would only need to oscillate a small amount to close the channel *g*, and thus limit the upward stroke of the hammer.

The Vauclain Drill

The illustrations show a new type of twisted drill, which has recently been brought out by A. C. Vauclain, 401 North Thirty-third street, Philadelphia, Penn.

Although the general appearance of the completed drill in Fig. 1 resembles other drills of this type at first glance, a careful examination will show wherein this lies, and the end view makes is perfectly clear.

In the drill of the usual section, the point is generally the thickness of the web, unless thinned down, and for this thickness there is an abrading or scraping action, which has always been one of



A GERMAN STEAM HAMMER

the difficulties in the way of rapid drilling of large holes, without an excessive expenditure of power. Thinning the point makes a sort of chisel cross section, which gives a negative cutting angle to the lip, and also weakens the drill.

In the new section it will be noted that the cutting edges of both lips meet at the center, so that the abrading of the point is done away with, and the drill actually cuts clear to the center. This requires a peculiar section, as can be seen from Fig. 2, which shows how the cutting edge is supported clear to the center. This makes it possible to use drills of any size, without the use of a small drill for the pilot holes, as is sometimes necessary with large drills of the usual type.

Tests made with this drill are said to show a very low power consumption, and instead of becoming red hot, as is often the case from the point friction, they are left comparatively cool, and the hole is left very smooth instead of being rough, as is sometimes the case with drills of the twisted type, under a heavy feed.

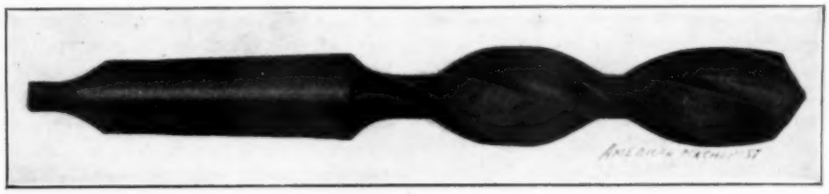


FIG. 1. THE VAUCLAIN CENTER CUT TWISTED DRILL

FIG. 2. HOW THE DRILL POINT LOOKS

Drucklieb Multiple Injector Sand Blast

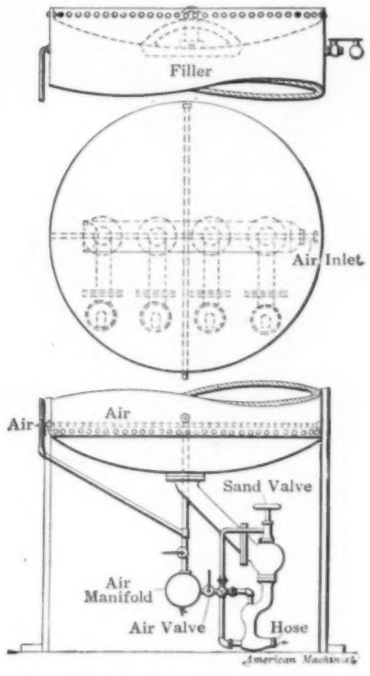
The sand blast shown herewith consists of a vertical cylindrical tank of riveted steel, holding either 2000, 4000, 6000 or 16,000 pounds of sand, with a central filling inlet in the concave top, in size from 4 inches diameter to 10x14 inches, closed by a quick-acting and positive cover.

The bottom of the tank is convex and is elevated sufficiently above the level of the ground to allow one, two, three or four 4-inch outlets to be attached by flanges, through which the sand flows in substantial connecting pipes, regulated by a special sand valve, so made that it cannot become jammed or plugged by the pressure of the sand. This valve is provided with a central air jet, which creates a partial vacuum and causes the sand to flow evenly.

Below this valve is a mixing chamber to which connections are made for the mixing and forcing jets of air and for the delivery hose.

The air for these three jets is taken from a riveted-steel manifold or receiver, lying horizontally under the sand tank, one quick-opening gate valve controlling the supply of air to each outlet.

From another connection, the air is piped from the manifold to the top of the sand tank to balance the pressure and enable the sand to flow without blowing back, and also to two horizontal perforated pipes near the bottom of the sand tank, through which the air passes, agitating the sand above the points of outlet, facilitating its flow. This connection is closed when the tank is to be refilled or closed down for the day.



DRUCKLEIB SAND BLAST

Each outlet is provided with the usual equipment of hose, nozzle holder and nozzles and is entirely independent of all of the others. The flow of sand through each one can be started, regulated or stopped without in any way interfering with or affecting the operation of any of the other outlets.

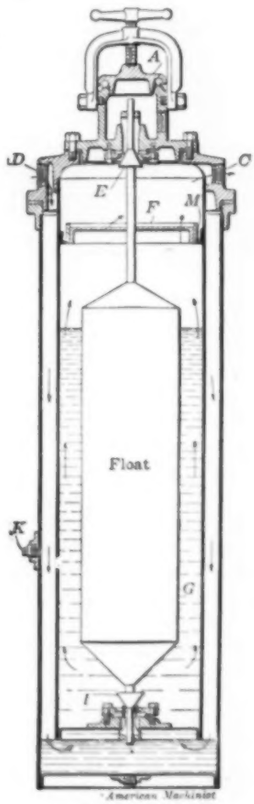
This sand-blast machine is known as the Drucklieb multiple injector sand blast, and is made by J. M. Betton, 178 Washington street, New York City.

Acetylene Relief Valve

This is a valve for safeguarding acetylene apparatus by preventing over pressure under any condition. The operation is as follows:

Water is admitted at *A* until it overflows at *K*. Plug *K* is then screwed in. The acetylene entering from the generator at *D* drives the water down in the outer compartment and up in the inner compartment. This raises the float opening the port *I* and closing the port *E*.

The acetylene now follows the course shown by arrows and enters the service pipe at *C*. In event of back pressure, the water being driven away from the float, the float falls, closing port *I* and opening port *E*, through which the gas is vented by a separate pipe line leading out of doors. Should the man in charge fail to fill this device with water port *I* would be closed and port *E* open. Hence this



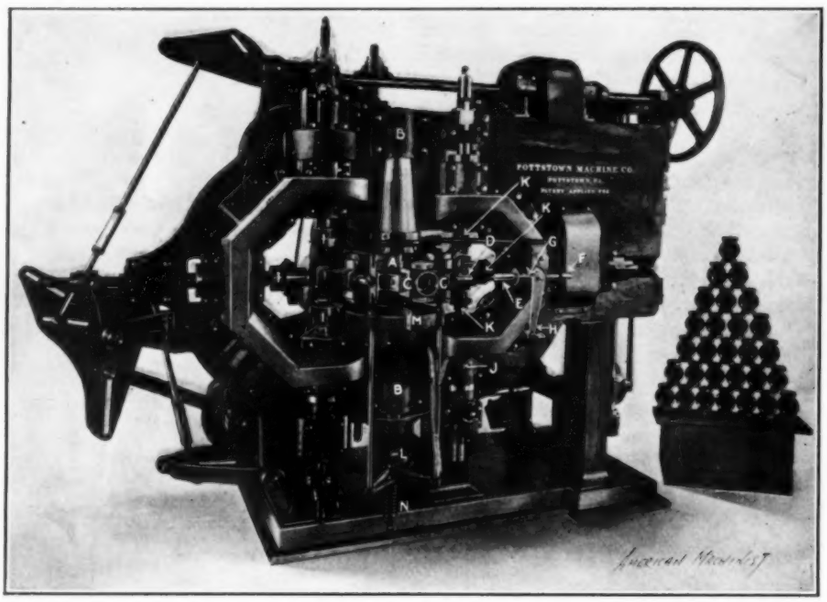
ACETYLENE RELIEF VALVE

device guards against forgetfulness and carelessness, for operators cannot get sufficient gas at blowpipes until the device is filled and the proper water levels thus established. It will take care of the full gas output of the generators for which they are sold, regardless of the number of blow pipes in use. It is made by Nelson Goodyear, 50 Church street, New York City.

A Multiple Operation Turret Machine

The halftone shows a new turret machine which has been brought out by the Pottstown Machine Company, Pottstown, Penn.

The machine shown was built for the production of globe valves but with different equipment of vise jaws and tools many varieties of work usually done with two or more chuckings can be handled by the machine.



A Multiple-operation Turret Machine

The turret *A* is hung in the bearings *B* and is equipped with four sets of work-holding jaws *C*.

The jaws, two in number, are operated by right- and left-hand screws with adjusting nuts to take up wear. The screw to the right, in operating position, is extended and provided with a square for the operating wrench. The arrangement of this wrench is very ingenious. *E* is a nurled sleeve with a square socket at the outer end fitting the square on *D*. It slides on a spline on the shaft *F* which is in line with *D* when *D* is in operating position. The shaft *F* is rotated by means of the miter gears *G*, one of which is secured to the same shaft as the operating crank *H*. With the turret in the position shown in the halftone, the operator slides the nurled box wrench *E* on the jaw screw *D* and turning the crank *H* in the one direction opens the jaws *C*. A globe-valve body is then inserted between the jaws and a reverse movement of the handle *H* closes the jaws. The wrench *E* is then slid to the position shown and the starting lever *J* is tripped. This indexes the turret, bringing the work in position to be operated on by the roughing reamers *I*. These size the tapped holes and rough ream the valve seat. While this is being done a new valve is being inserted at the front position. The second indexing carries the rough-reamed valve body to the rear where it is finish reamed. The third indexing carries it to position to be operated on by the taps *K*. These taps are all provided with leaders to insure threading to correct pitch.

The whole machine is very rigid. The turret is hung between bearings which are spaced a considerable distance from each other and is surrounded by the body of the machine so that there is little tendency to spring or chatter. The turret is locked in the usual way and while the tools are at work a cam at the back operating on the lever *L* forces the yoke *M* downward which binds the turret immovably in its seat. At the movement of indexing the yoke *M* is forced upward by the spring *N*, which leaves it free to turn. Simple built up tools are used easily accessible for setting and removable for sharpening. Adjustments are supplied wherever necessary. The machine shown will handle globe valves from ½ inch to 2 inches inclusive. It will finish ½-inch brass valve bodies at the rate of six per minute and 2-inch bodies as the rate of four per minute.

The machine is so arranged that it is impossible for the operator to move the turret until the automatic gripping device is released. This takes place the moment the taps are clear of the work.

Huge Tubular Micrometer Calipers

Chief interest in the tubular micrometer calipers shown in the accompanying halftone is on account of their unusually large size, an idea of which is readily appreciated from the relative hight of the man shown. The construction of these tubular frames was recently described in our columns, and they are manufactured up to a size of 78 inches in diameter by the Davis Manufacturing Company, Milwaukee, Wis.

Large Tubular Micrometer Calipers

Our school books tell us that the weight of a body varies inversely as the square of its distance from the center of the earth. This fact, combined with the laws of falling bodies leads to the rather startling result that if a body were to be projected vertically from the earth's surface with an initial velocity of 7 miles per second, it would *never come back again.* In our own school days this fact never appeared as a menace to our staying on earth for the period of a natural lifetime, but now that aviators have taken to skirting the upper fringes, it might be well to paint speed-limit signs on the clouds lest these men should literally "fall off the earth." There really is not much cause for worry, however, as the figure given assumes no air resistance, and with no air resistance there will be no aviators.

In the Jones Speedometer Factory

By Ethan Viall

Details of a die for swaging keys on small shafts.

Using a master plate and a pin for locating holes to be drilled in small brass plates.

A training machine and the way it is used.

Testing speedometers.

One of the many things that attracted my attention on a recent visit to the Jones Speedometer Company, New Rochelle, N. Y., was their method of swaging keys on the ends of governor shafts, in a punch press. These shafts were placed in the die at *A*, Fig. 1, being clamped securely by means of the hand lever *B*, which turns the cam *C* and operates the clamp *D*. The key is swaged up on the end of the shaft by two punches which are forced inward by the descent of the punch *E* onto the wedge-shaped pieces *F F*. The stroke of these punches is regulated both by the adjustment of the press ram and of the two thumb screws *G G*.

Fig. 2 shows this swaging die in detail, *A A* being the swaging punches; *B* the shape of the swaged shaft end; *C C* the parts that force in the punches; *D* the clamp operated by the hand-lever cam and *E E* the adjusting screws.

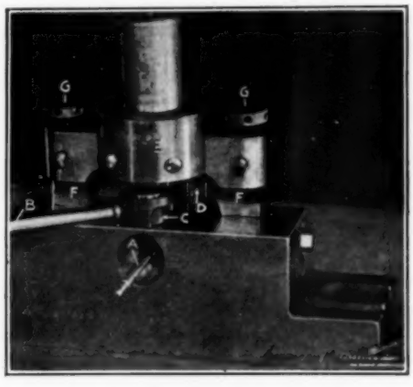


FIG. 1. KEY-SWAGING PUNCH AND DIE

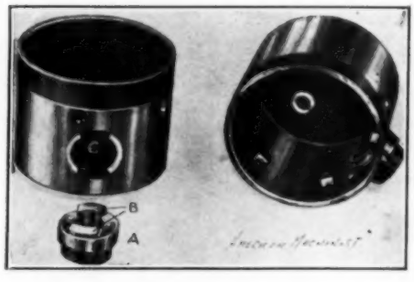


FIG. 3. METHOD OF KEYING SLEEVES INTO SPEEDOMETER CASES

Fig. 3 shows the way the driving-shaft sleeves are placed in the speedometer outer case so as to be perfectly radial. The sleeve *A* has two L-shaped projections *B*, which pass through the slots in the bottom of the counterbored hole *C*, and when the sleeve has been inserted it is given a quarter turn which locks it in, after which solder is run around the joint, securely fastening the sleeve in place.

LOCATING HOLES WITH A MASTER PLATE

There are many ways of locating holes for drilling small plates, some good, some bad. Often the plate is placed in a jig with a cover filled with bushed holes; again, the holes are all spotted at once with a punch and then drilled, but in the shop under discussion the side plates for holding the inner speedometer mechanism, are "doweled" to a master plate by two pins and the holes to be drilled are located by hardened-steel bushings in the master plate, which fit over a pin in the platen of the drill press directly in line with the center of the drill spindle, as illustrated in Fig. 4. In this halftone, *A* is the master plate; *B* the "dowel" pins; *C* the drilled plate and *D D* locating pins. Of course, the holes are first spotted, then drilled and finally reamed, in machines similar to the one shown, different spindles being used for the different-sized holes, though the holes in the master-plate bushings are all the same size, as are the locating plugs in the platen.

This is an application, in a manufacturing way, of the master-plate boring method followed in many watch-factory tool rooms or other similar shops.

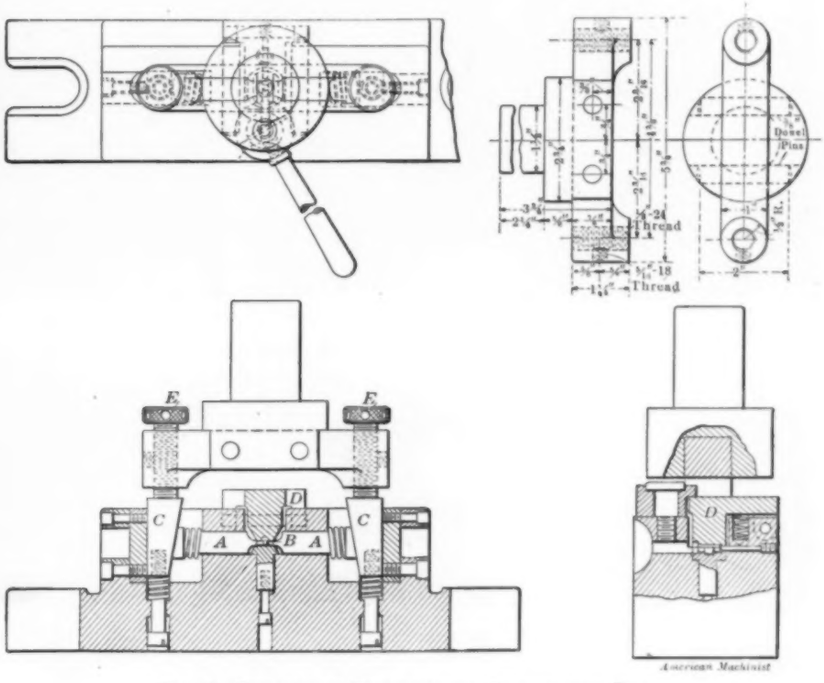


FIG. 2. DETAILS OF KEY-SWAGING PUNCH AND DIE

THE TRAINING MACHINE

Front and back views of what is known as a training machine, are shown in Figs. 5 and 6. This machine is used to press the small gear wheels, that revolve on the same center, together so that the gear teeth will always have the same definite relation to each other. An idea of what is meant will be gained by looking at the sketch, Fig. 7, which, while not absolutely accurate, is near enough to convey the idea intended, and it will be seen that the primary gear of this cluster is one with a long sleeve over which are pressed one or two other gears as the case may be, and it will also be seen that where these gears mesh into others of a train the positions of the teeth of the various gears must be absolutely correct.

Referring now to the front view, Fig. 5, the gear with the long sleeve on it is placed in a recess in the end of shaft *A*, which just fits the teeth; another gear wheel is placed in plug *B*, then the foot lever under the bench is pressed, moving the segment *C* which revolves pinion *D*, onto the shaft of which the cam *E* is

fastened; this causes shaft *A* to move forward and the gear wheel at *B* is pressed over the sleeve of the gear in the end of the shaft. If another wheel is to be pressed on, the head *F* is indexed one hole by means of handle *G*

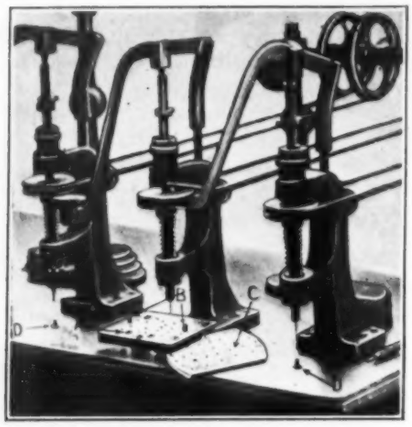


FIG. 4. SMALL DRILLS, MASTER PLATE, LOCATING PINS AND SPEEDOMETER SIDE PLATE

head have hardened, ground and lapped bushings and the index-latch pin is also carefully lapped to fit them. Holes *J* and *K* are wrench holes and by means of these the plugs on the face of the head may be adjusted, as they are connected to the wrench holes by bevel gears and after being adjusted, the plugs are locked by set screws. The handle *L* is a part of the spindle pin on which the indexing head rocks and by pulling this out the head may be removed and another with a different setting substituted.

APPARATUS FOR TESTING SPEEDOMETERS

Fig. 8 shows the works of a number of speedometers being tested for accuracy, only a slight error causing them to be rejected.

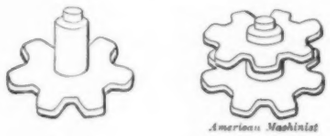


FIG. 7. SKETCH SHOWING WAY SMALL GEAR WHEELS ARE PRESSED TOGETHER IN TRAINING MACHINE

In Fig. 9 are shown the cone wheels on which the completely assembled speedometers are tested, each step of the cone representing a definite speed in miles to which the instrument must register. These machines are carefully calibrated with standards at frequent intervals, so as to minimize the chance of error and so carefully is this done that two instruments tested on these machines and sent to the Bureau of Standards at Washington and tested for every five miles within their limits, proved all that could be desired.

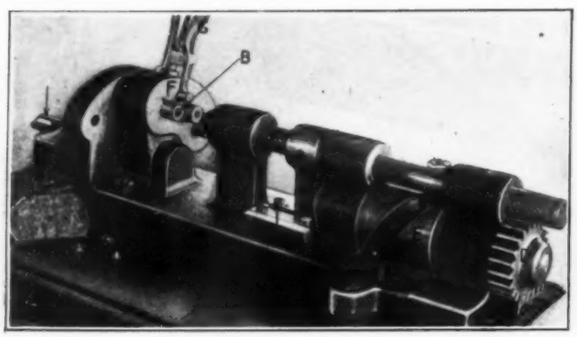


FIG. 5. FRONT VIEW OF TRAINING MACHINE

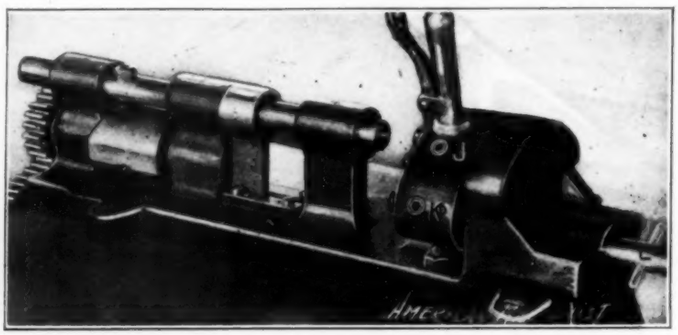


FIG. 6. REAR VIEW OF TRAINING MACHINE

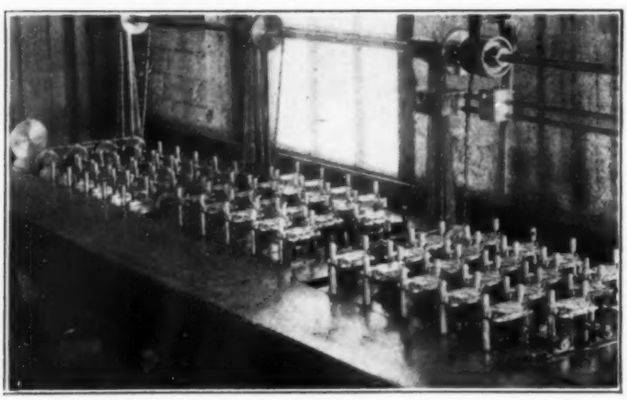


FIG. 8. MACHINE FOR GIVING EACH MECHANISM A RUNNING TEST

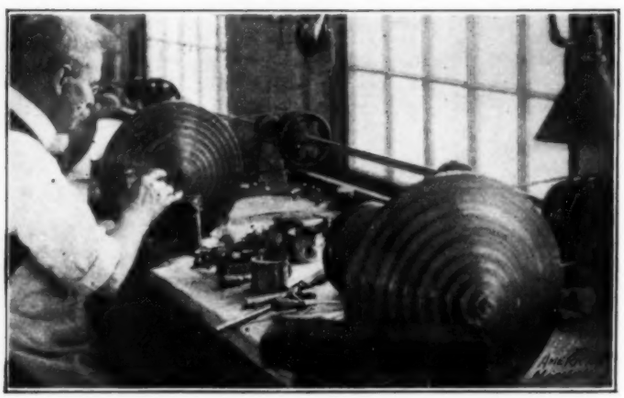


FIG. 9. TESTING THE ASSEMBLED SPEEDOMETERS AT VARIOUS SPEEDS

and the operation repeated. In order that there may be no twisting motion to shaft *A* while moving forward, the slide arm *H* runs between carefully adjusted ways at *I*.

The rear view, Fig. 6, shows the end of spindle *A* with the small sleeve gear in place. All the indexing holes of the

Convention of Supply Men

The triple joint convention of the Southern Supply and Machinery Dealers' Association, National Supply and Machinery Dealers' Association and American Supply and Machinery Manufacturers' Association was held in Louisville, Ky., on April 3, 4 and 5.

It was one of the most enthusiastic meetings these associations have ever held and was largely attended, about 400 members being present.

The following officers were elected for the ensuing year:

Southern Supply and Machinery Dealers' Association: President, W. P. Simpson, C. T. Patterson Company, New Orleans, La. First vice-president, S. M. Price, S. M. Price Machinery Company, Norfolk, Va. Second vice-president, J. F. Young, Young & Vaun Supply Company, Birmingham, Ala. Secretary-treasurer, Alvin M. Smith, Smith Courtney Company, Richmond, Va.

National Supply and Machinery Deal-

ers' Association: President, W. L. Rogers, Pittsburg (Penn.) Gage and Supply Company. First vice-president, Henry Prentiss, Prentiss Tool and Supply Company, New York City. Second vice-president, J. O. Harron, Harron, Rickard & McCone, San Francisco, Cal. Secretary-treasurer, Thos. A. Fernley, Philadelphia, Penn.

American Supply and Machinery Manufacturers' Association: President, Willard Parker, Pennsylvania Shafting Company, Spring City, Penn. First vice-president, U. A. Gladding, E. C. Atkins & Co., Indianapolis, Ind. Second vice-president, D. K. Swartwout, The Ohio Blower Company, Cleveland, O. Third vice-president, C. H. Jenkins, Moran Flexible Steam Joint Company, Louisville, Ky. Secretary-treasurer, F. D. Mitchell, New York City.

New Jersey's Liability and Compensation Law

The State of New Jersey has just passed the Edge employers' liability law. Assistant Attorney-General Gaskill, in response to a number of requests for a summary of the law, makes this statement regarding the operation of the new bill:

"Under the employers' liability law, any employee may recover for injuries, or his personal representatives may recover for his death, damages from the employer by either one of two methods, the choice of which must be made before the injuries are received or the death occurs. The employee may have but one of these remedies and cannot exercise both.

"As a part of the contract of employment, in every case an agreement is implied between employer and employee by which the compensation schedule becomes operative, unless prior to accident, either party gives notice to the contrary. Where no such notice is given by the employer or employee, the employee recovers compensation according to the schedule in every case of injury, except where the injury is due to his deliberate and intentional act or to his intoxication.

"This compensation is fixed in great detail, and in case of dispute a simple procedure is prescribed, whereby the dispute is referred to the judge of the Court of Common Pleas in the county where the accident happens or the injured employee lives. The court renders judgment and this is the end of litigation. Thereafter all proceedings can only be for the recovery of money established to be due by such judgment. This money comes in weekly payments, but where a proper case is presented the weekly payments may be commuted by the judge to a lump sum.

"In case either the employer or the employee decides, prior to an accident, not to accept the compensation schedule, then recovery is to be had by suit in the courts, as at present, with the exception that the defenses of fellow-servant and assumption of risk are abolished and contributory negligence is modified to wilful negligence and is in every case a question for the jury, so that the power of a court to nonsuit in such cases is taken away.

"It is believed that the decision of the New York courts with reference to the bill passed by the New York Legislature will not affect this bill, because the basis of the two is very different, and the decision in New York does not touch the plan included within the present law."

Hazard of Dynamic Power in Industry

At a recent meeting of the American Society of Mechanical Engineers on industrial accidents and their prevention, stress was laid by one speaker upon the hazards that had entered industry from the employment of dynamic power, the thought being that the dangers exist in industry because power is used.

That this is not so is proved by the advance sheets of a book about to be issued by the National Association of Manufacturers, giving the report of a special committee sent to Europe to study industrial accidents, their prevention and compensation. We quote, "We have had five charts prepared from the statistics of the German Empire, which tell a surprising story.

"After studying these charts it would seem of little use to construct laws or adopt systems which do not cover the farmer. He stands first on each of the five charts with 43½ per cent. of the *total* number of injured; 30 per cent. of the *total* number of dead; 32½ per cent. of the total number of permanently completely incapacitated; 45 per cent. of the total permanently partly incapacitated and 45 per cent. of those temporarily incapacitated,"and farming is an industry that does not employ power-driven machinery to but a limited extent.

Thus, there are inevitable hazards of industry that do not come from the use of dynamic power.

Increasing Shop Capacities

METAL WORKING

NEW ENGLAND

The water department, Middletown, Conn., will build a new repair shop.

The Wyman & Gordon Company, Worcester, Mass., manufacturing drop forgings, is preparing to enlarge.

R. S. Wilbur, Plimpton, Mass., has purchased a shop in which he will manufacture double-pointed tacks.

Gilbert & Bennet Manufacturing Company, making wire goods, Georgetown, Conn., will erect two new buildings.

The Pairpont Manufacturing Company, New Bedford, Mass., manufacturing silver plate, etc., will erect a four-story addition.

A new concern, with Dr. W. F. Kenney president, Providence, R. I., has been incorporated in that State at $100,000 to manufacture the Kenney lock nut.

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

The Watson & Newell Manufacturing Company, jewelers and silversmiths, Attleboro, Mass., is to erect a large addition to its present factory. New equipment will be added.

MIDDLE STATES

Henry Disston & Sons, Inc., are having a garage built at Tacony, Penn.

The Lake Erie Foundry Company, Erie, Penn., is erecting a two-story addition.

W. T. Bryan is having a garage built at 370 West Duval street, Philadelphia, Penn.

Plans have been prepared for a new foundry for the Erie City Iron Works, Erie, Penn.

Paiste & Co. are having a garage built at Twenty-third and Arch streets, Philadelphia, Penn.

Bornot Brothers are building a garage at Sixteenth and North streets, Philadelphia, Penn.

J. L. Hermann is having a garage built at Forty-first and Aspen streets, Philadelphia, Penn.

G. A. Kirchner is having a garage built at Twelfth street and Leigh avenue, Philadelphia, Penn.

The Miami Cycle and Manufacturing Company, Middletown, Ohio, will erect two additional buildings.

F. Storsberg, Newark, N. J., manufacturing gas and electric-light fixtures, will build an addition to his plant.

The Buckeye Brass Company, Dayton, Ohio, is preparing to erect an addition to its plant to consist of several stories.

Baldwin, Tuthill & Bolton, Grand Rapids, Mich., manufacturers of sawmill machinery, will erect a three-story addition.

Syracuse Chilled Plow Company will soon break ground for an additional building at Syracuse, N. Y., to cost $50,000.

F. A. Bowden, 3500 West Forty-first street, Cleveland, Ohio, has taken out a permit for a garage which will cost $6000.

The Atlas Steel Casting Company, Buffalo, N. Y., recently incorporated, is preparing to erect a factory in North Buffalo.

The Roosevelt Worsted Mills, 2023 Naudain street, Philadelphia, Penn., has leased another plant and will increase capacity.

The Thomas Manufacturing Company, Springfield, Ohio, manufacturing farm implements, etc., is planning to enlarge its foundry.

The American Railway Supply Company, Westfield, N. Y., will remove its locomotive-parts manufacturing plant to Conneaut, Ohio.

The Craig Engineering Company is buying machinery for the manufacture of gas engines at its new plant at Jersey City, N. J.

The Tioga Steel and Iron Company is building an addition to its plant at Fifty-second street and Granger avenue, Philadelphia, Penn.

The Lodge & Shipley Machine Tool Company is planning an addition to its plant on Colerain avenue, Camp Washington, Cincinnati, Ohio.

Fire which practically destroyed the foundry of James G. Martin, Middletown, N. Y., did about $10,000 damage. Much machinery was ruined.

The Hatfield Manufacturing Company, building auto trucks, which removed its plant to Elmira from Cornwall, N. Y., will install some new equipment.

The North Brothers Manufacturing Company, of Philadelphia, Penn., manufacturer of all kinds of hardware, is building a new plant at Chester, Penn.

The Long Island Railroad Company will soon be in the market for a large list of machine tools. G. C. Bishop, superintendent motive power, Morris Park, N. Y.

The Federal Miniature Electric Lamp Company, Cleveland, Ohio, has been incorporated to manufacture small electric lamps by J. M. See, C. C. Gale and others.

The Pennsylvania Railroad will equip the old rolling mill of the Republic Iron and Steel Company, at Toledo, Ohio, recently purchased, for repair and car shops.

The Automatic Rural Mail Box Company, recently organized in Detroit, Mich., will locate its manufacturing plant in Schenectady, N. Y., employing about 100 hands.

The Carroll-Porter Boiler Company, Pittsburg, Penn., will double the capacity of its plant at Wellsville, Ohio, and will start to make steel river barges and flats.

The Tyler Furnace and Manufacturing Company, Cleveland, Ohio, has been incorporated for $10,000 capital. Incorporators, E. W. Tyler, B. E. Corlett and L. R. Dunham.

The Gordon Electric Company, Chicago, Ill., has been incorporated to manufacture electrical appliances. Capital, $25,000. Incorporators, S. Geo. Levy, M. Levinson, I. B. Lipson.

Frederick Mason and Edward Cardinal, of Rochester, N. Y., are interested in a project to establish a plant for the manufacture of roll strip steel. Plant will employ about 350 men.

The Haskell-Barker Car Company, Michigan City, Ind., will enlarge its plant and engage in the manufacture of steel cars. It is stated that nearly $5,000,000 will be spent in improvements.

The Newark Wire Cloth Company, Newark, N. J., has been organized to manufacture wire goods and novelties. Capital, $50,000. Incorporators, John Campbell, Jr., A. H. Stephens, W. J. Davis.

The National Scrubbing Machine Company, Chicago, Ill., has been incorporated to manufacture scrubbing machines. Capital, $50,000. Incorporators, Geo. S. Pines, Edw. R. Newman, A. J. Goldfin.

The National Boiler Company, Garwood, N. J., has been incorporated to manufacture boilers, stoves, furnaces, etc. Capital, $150,000. Incorporators, Luke V. Lockwood, A. J. Albert, R. L. Redfield.

New Jersey Gas and Electric Fixture Works, Passaic, N. J., has been organized with $10,000 capital by Chas. Korshat, Max M. Blake and Henry Bromberg, to manufacture gas and electric fixtures.

The Morgan Motor Truck Company, New York, has been organized to manufacture machinery, motor vehicles, etc. Capital, $10,000. Incorporators, L. Robinson, W. U. Goodbody, H. B. Leary, all of 55 Broadway.

The Eckerson Motor and Carriage Works, Closter, N. J., has been organized to manufacture automobiles, carriages, etc. Capital, $25,000. Incorporators, G. D. Eckerson, D. G. Moore, Closter; H. M. Bertody, Tenafly.

The Edward Ermold Company, New York, has been incorporated with $80,000 capital to manufacture machinery, etc. Incorporators, Edward Ermold, 654 Hudson street; W. A. Guthrie, 143 West Eleventh street, etc.

The Standard Galvanizing and Manufacturing Company, Cleveland, Ohio, has been incorporated for $15,000 to do a galvanizing and manufacturing business. Incorporators, G. T. Bander, Chas. T. Denly and G. S. Catchpole.

The Jeffries Electric and Manufacturing Company, Cleveland, Ohio, has been incorporated with $10,000 capital to do a general manufacturing business. The above firm has been incorporated by S. S. Jefferies, of Cleveland, Ohio.

The Improved Cold Water Shrinkage Machine Company, Rochester, N. Y., has been incorporated to manufacture machines for shrinking cloth. Capital, $10,000. Incorporators, J. G. Rosenberg, August Phillips, Edw. Rosenberger.

Electric Service and Equipment Company, Toledo, Ohio, has been incorporated with $10,000 capital to manufacture and sell electrical automobiles and electrical appliances, by Ralph W. Heitt, Thomas Biddle, George E. Dixon, etc.

The Cleveland Motor Truck Company, Cleveland, Ohio, has been incorporated for $250,000 to build motor trucks for commercial use. A. W. Johnston, W. M. Hagar, R. H. Sharp, H. W. Woodward and John Krause are the incorporators.

The Reliance Tire Chain Company, New York, has been incorporated to manufacture anti-skid chains for auto tires, etc. Capital, $10,000. Incorporators, Wm. P. Coe, 240 East Seventy Eighth street; W. S. Sawyer, 108 West Ninety Fifth street, etc.

John H. Claxton, secretary of the board of education, at Yonkers, N. Y., will receive bids until April 14, for power-transmission apparatus for the Saunders Trades school, now being built, and will receive bids until May 1 for other machinery for the same school.

The New Jersey Arnold Damper Company, Newark, N. J., has been incorporated with a capital of $300,000 for the purpose of manufacturing automatic dampers, flue governors, etc. Incorporators, D. M. Cook, Newark; A. W. Arnold, F. E. Arnold, of New York, and others.

The Ohio Valley Brass and Iron Company has been incorporated for $75,000 to begin manufacturing in Wellsburg, W. Va. The firm will produce plumbing-supply goods and steam specialties. Incorporators, W. M. Pattison, J. V. Kennedy and C. H. Frazer, all of Cleveland.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids April 25, for two traveling cranes for the Charlestown navy yard, as per Schedule 3458, also one radial drill, two engine lathes, one boring and drilling machine, one boring and turning mill as per Schedule 3459.

SOUTHERN STATES

The Gibbs Machinery Company, Columbia, S. C., will build an addition to its shop and install several new machines.

The Sheet Metal and Specialty Company, Follansbee, W. Va., has awarded contract for the erection of an addition to cost about $10,000.

Chas. C. Eckenrode has applied for a permit to erect a three-story automobile and carriage factory at 16-22 North Carrollton avenue, Baltimore, Md.

The International Harvester Company, of Chicago, has purchased site at Gordon Heights, a suburb of Bessemer, Ala., and will erect a branch factory.

WEST OF THE MISSISSIPPI

Abe Mueller, of Roman, Mont., will erect a two-story blacksmith shop.

King & Winge, Alki avenue, Seattle, Wash., will build a new machine shop.

Woodward Brothers, Perris, Cal., will build a commercial garage and repair shop.

Wm. Ridpath, Portland, Ore., will build a commercial garage and repair station.

The Pacific Gear and Tool Works, Inc., San Francisco, Cal., will build a new machine shop.

The Schroth Company, San Francisco, Cal., will build a new commercial garage and repair shop.

Bell, Wildman & Co., Portland, Ore., has purchased a site and will erect a new machine shop.

Sibley & Son, Moneta (near Los Angeles), Cal., will build a new machine shop and repair works.

Mr. Tuerck, 208 Madison street, Portland, Ore., has taken out a permit to build a new machine shop.

George Machris, Los Angeles, Cal., is having plans prepared for a commercial garage and machine shop.

The Eureka Stone and Ore Crusher Company, of Cedar Rapids, Iowa, will erect a two-story addition.

William Lynch, Woodlawn avenue, Los Angeles, Cal., iron worker, has taken out a permit to erect a new shop.

William Reidt, Portland, Ore., will build a commercial garage and repair shop. About $30,000 will be expended.

W. G. Stoner, Toppenish, Wash., is planning to build a commercial garage and repair shop. Modern equipment will be installed.

E. J. Gray has leased quarters at 512-8 East Fifth street, Los Angeles, Cal., and will establish a plant for the manufacture of gas-pipe fittings.

The car barns and shops of the Los Angeles-Redondo Railway, at Redondo, Cal., will be doubled in capacity. Headquarters of company, Los Angeles.

The Spring Pipe Threader Manufacturing Company, St. Louis, Mo., recently organized, will establish a plant for the manufacture of spring pipe threaders, cutters and vises. Will need equipment, including milling machines, lathes, grinders, etc.

CANADA

Moffatt & Irving, Toronto, will build a large steel and iron foundry.

The Canadian Pacific Railroad will build a big new boiler shop at Winnipeg.

The Nova Scotia Car Company, Ltd., Halifax, N. S., is placing orders for equipment for its enlarged plant.

The Petrie Manufacturing Company, of Hamilton, Ohio, will locate a branch factory at Edmonton, Alberta. The concern manufactures cream separators.

FOREIGN

Aktiebolaget Ekstroms Maskinaffar, Unionsgaten 30, Helsingfors, Finland, is in the market for machinery for making wood screws.

General Manufacturing

NEW ENGLAND

Putnam, Conn., will spend $30,000 improving its water system.

Danvers, Mass., is contemplating the erection of a new power house.

The Sanitary Cement Company, Everett, Mass., will erect an addition.

Colby Academy, New London, N. H., will install entire new power plant.

The Hutchins Organ Company will build a new factory at Waltham, Mass.

The Dumbarton Woolen Mill, Dexter, Me., will be equipped for electric drive.

Longmeadow, Mass., is contemplating the erection of a new pumping station.

The Dunn Worsted Mills, Woonsocket, R. I., is to double the capacity of its plant.

The town of Athol, Mass., has voted $30,000 to establish a waterworks system.

The town of Longmeadow, Mass., will install a 25- to 30-horsepower gasolene engine.

The Westport (Conn.) Water Company will enlarge its plant and install new equipment.

The town of North Haven, Me., care John Crockett, will install a crude-oil or gasolene engine.

The city of Newburyport, Mass., will install a 3,000,000-gallon high-duty pumping engine.

The plant of the Maine Red Granite Company, Red Beach, Me., was destroyed by fire. Loss, $20,000.

The city of Quincy, Mass., is to expend $200,000 for improvements of water mains, fixtures and meters.

The American Building Trust, Boston, Mass., will install boiler, gas producer, electric-light plant, pumps, etc.

E. E. Davis, Northampton, Mass., is interested in a project to erect an electric power plant at Chesterfield, Mass.

The carpet plant of the Cochrane Manufacturing Company, Dedham, Mass., was destroyed by fire. Loss, $200,000.

The Barnaby Manufacturing Company, Fall River, Mass., cotton manufacturer, is to erect a large addition to its plant.

Charles Blanchard, Whitinsville, Mass., is to engage in the laundry business at Manchester, N. H. Equipment will be required.

The toy plant of H. E. Bartlett, at Leominster, Mass., recently destroyed by fire at a loss of $25,000, is to be rebuilt immediately.

The Providence (R. I.) Dyeing, Bleaching and Calendering Company expects to erect an addition to its plant and install another engine of about 200 horsepower.

The Philadelphia & Reading Railroad will erect a coal pocket of 1000 tons capacity at Salem, Mass. A considerable amount of hoisting and coal-handling machinery will be needed.

The Standard Woven Fabric Company, Worcester, Mass., has been incorporated to manufacture and deal in belting, hose, etc. Capital, $400,000. Incorporators, H. F. Barrup, J. E. Clarke, Wm. K. Wheeler, all of Athol, Mass.

MIDDLE STATES

The city of Cleveland, Ohio, is planning a sewage-disposal plant.

The Defiance (Ohio) Carriage Company will erect a new factory.

The Bramcote Dye Works, of Pottstown, Penn., was destroyed by fire.

The Willis Jones Dairies are having a creamery built at Yerkers, Penn.

The Klinkert Brewing Company, of Racine, Wis., will erect a bottling house.

Richardson gas plant, at Dover, Del., is building an addition to cost $40,000.

L. F. Neuweiler & Son are having a five-story brewery built at Allentown, Penn.

The Enterprise Cigar Company, Trenton, N. J., will build an addition to its plant.

The Capron Knitting Company, Utica, N. Y., will build a new mill with increased facilities.

The John T. Dyer Company, of Roberson, Penn., is erecting a large stone-crushing plant.

The Universal Paint Company will build a paint factory at Syracuse, N. Y., to cost $100,000.

The Philadelphia (Penn.) Racquet Club is to build an addition and install several new dynamos.

The Drum Elevator Company, 103 Walker street, New York, is to erect a new plant in Brooklyn.

The Capron Knitting Company, Utica, N. Y., will enlarge its plant by building an additional mill.

The Lake City Ice Manufacturing Company, Cleveland, Ohio, will greatly enlarge its plant at once.

The Harmony Mills, cotton, at Cohoes, N. Y., is in the market for more machinery to equip its plant.

The asphalt factory of the Stowell Manufacturing Company, Pollock avenue, Jersey City, N. J., was burned.

The Norfolk & New Brunswick Hosiery Company, New Brunswick, N. J., will erect an addition to its plant.

The Standard Oil Company, of Cleveland, Ohio, will erect an oil-distilling building, which will cost $36,000.

The Alpha Knitting Mills is erecting a new five-story building at Fifth and Spring Garden streets, Philadelphia, Penn.

G. F. Thompson is having an addition built to his dye works at Horrocks and Orthodox streets, Philadelphia, Penn.

Ore-handling machinery of the Erie Railroad Company, at North Randall, Ohio, has been destroyed by dynamite.

Thos. B. Stockham & Brother, Morrisville, N. J., will erect a large planing mill on Washington and Chambers street.

W. H. Luden is having plans prepared for an addition to his candy factory on North Eighth street, Reading, Penn.

Schufelt Manufacturing Company, makers of knit goods at Oswego, N. Y., is about to erect a new factory building.

The Girard Estate is to erect a heating and electric-lighting plant at Twentieth and Oregon streets, Philadelphia, Penn.

The Quaker City Rubber Company is building a two-story addition at County and Minor streets, Philadelphia, Penn.

The A. C. Cheney Piano Action Company, Castleton, N. Y., contemplates increasing the size of its plant this summer.

The factory of the Fox Optical Company at Eighteenth and Ludlow streets, Philadelphia, Penn., was destroyed by fire.

The Booth Detachable Auto Rim Company, Cleveland, Ohio, is to enlarge its factory. Will install new hydraulic presses, etc.

The Devine & Yungel Shoe Manufacturing Company, Harrisburg, Penn., will erect a new factory, having outgrown its present quarters.

Work has been commenced on new $650,000 power plant at East Chicago, Ind., for the Northern Indiana Gas and Electric Company.

The planing mill of the Attwood Lumber Machinery and Manufacturing Company, at Park Falls, Wis., was burned. Loss, $10,000.

The Kristan Baking Company, Chicago, Ill., has purchased site at Elston avenue and Augusta street, and proposes erecting a $150,000 plant.

The Toledo Artificial Limb Company, Toledo, Ohio, has been incorporated by Wm. Bluff and others to manufacture artificial limbs.

The Sanitary Table and Manufacturing Company, Cleveland, Ohio, has been incorporated by F. Harding, C. F. Judson and others.

The Interstate Stone Company, of Lewisburg, Ohio, has secured sixty acres of stone land near that point and will open up a quarry.

The Charles Boldt Company, Cincinnati, Ohio, will erect a new factory on Davis lane for the manufacture of bottles and glass sundries.

The Smith Agricultural Chemical Company, of Columbus, Ohio, will soon start the erection of a large fertilizer plant at Indianapolis, Ind.

Bowker Fertilizer Company, Elizabeth, N. J., will increase the capacity of its power plant. Will install new boilers and other improvements.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids April 18, for gasolene engine as per schedule 3451.

The four-story fertilizing plant of Berg & Co., of Ontario and Richmond streets, Philadelphia, Penn., was destroyed by fire. Loss, $100,000.

The boat-building plant of the Monongahela River Construction Coal and Coke Company, at Browns Landing, Penn., was destroyed by fire.

The Alpha Knitting Mills has purchased site at Sixth and Spring Garden streets, Philadelphia, Penn., and will erect a five-story building.

At Akron, Ohio, the contract to build a power plant for the Northern Ohio Power Company has been awarded to James E. Southard & Co.

The Hemingway Canning Company, Lyons, N. Y., will remodel the plant of the Lyons Beet Sugar Company and equip the same for a canning plant.

Power-plant equipment will be required for the 12-story hotel to be erected for J. A. Sanders, at Cleveland, Ohio. Fred W. Striebinger, architect.

John T. Bailey & Co., manufacturers of rope, twine and bags, are erecting a four-story building at Water and Tosker streets, Philadelphia, Penn.

The Harriman Industrial Corporation will build a large mill and shop at Harriman, Orange county, N. Y. Company will do contracting and building work.

The Dayton Art Glass Manufacturing Company, of Dayton, Ohio, is planning to erect another factory building. The new structure will treble the present floor space.

A contract has been let for an addition to the plant of the Forest City Brewing Company, Cleveland, Ohio. An ice-making machine of 80 tons daily capacity will be installed.

The mills of S. B. and B. N. Fleisher, of Manayunk, Philadelphia, manufacturers of worsted yarns, was badly damaged by a wind and rain storm. Valuable machinery was totally destroyed.

The Excello Silk Company, Paterson, N. J., has filed articles of incorporation for the purpose of manufacturing silk, etc. Capital, $20,000. Incorporators, Daniel Patrick, H. T. Johnson, Henry Green.

Prudential Rubber Company, Akron, Ohio, has been formed with $10,000 preliminary capital, to manufacture all kinds of rubber articles by Frank C. Meilhoff, Edward A. Meilhoff, G. B. Motz, etc.

Split Fiber Keg Manufacturing Company, Cincinnati, has been organized to manufacture kegs and casks. Capital, $30,000. Otway R. Yeazell, Max J. Schurmann, Raymond A. Yeazell, etc., incorporators.

The Sandusky Portland Cement Company has increased its capital stock from $400,000 to $3,000,000. Improvements costing $200,000 will be made to the Bay Ridge (near Sandusky), Ohio, and Dixon, Ill., plants.

The Hercules Tire and Rubber Company, Pittsburg, Penn., has been organized with $100,000 capital to manufacture rubber tires for automobiles, etc. Incorporators, E. G. Bossinger, Jos. T. Murray, F. L. Cleveland.

The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until 11 a.m., April 29, for air compressor and accessories for naval station at Pearl Harbor, Hawaii. Specifications can be had of the bureau.

Alexander Brothers, manufacturers of leather belting, Philadelphia, Penn., have awarded contract for the construction of a new factory at 414-16 North Fourth street. Plans for enlarging power plant are also being considered.

Power equipment will be required for the 16-story office building and 12-story hotel to be erected at Cleveland, Ohio. Myron T. Herrick is head promoter and D. H. Burnham, of Chicago, is the architect. About $4,500,000 will be expended.

The Acme Veneer and Body Company, Rahway, N. J., has been incorporated with $100,000 capital to manufacture automobile, carriage and wagon bodies, etc. Incorporators, H. A. Grube, F. P. Gallagher, Rahway; A. L. Kull, New Rochelle, N. Y.

The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids up to 11 a.m., April 29, for six 450-horsepower water-tube boilers, equipped with oil-burning apparatus, superheaters, flue and stack for naval station, Pearl Harbor, Hawaii.

The Enamel Vitrified Brick Company, Toledo, Ohio, has been incorporated by J. J. Urschel, William Urschel, C. E. Holden, George C. Penny and E. S. Smith, with a capital of $200,000 for the purpose of erecting a plant for the manufacture of the vitrified brick.

Bids will be received at the Frankford Arsenal, Philadelphia, Penn., until 1 p.m., May 5, for material for the year ending June 30, 1912, including smokeless powder, steel and iron, iron castings, hardware, electrical supplies, leather belting, etc. Information can be had of the commanding officer.

SOUTHERN STATES

Fire destroyed the plant of the McLean Lumber Company, Chattanooga, Tenn. Loss, $60,000.

The Sumpter (S. C.) Lighting Company will make extensive improvements. New transformers will be installed.

The Baltimore & Ohio Railroad has awarded contract for the erection of a cold-storage warehouse in connection with its new produce yards on Sharp street, Baltimore, Md.

WEST OF THE MISSISSIPPI

The city of Troy, Ida., will install a new waterworks system.

Charles Schmidt of Manning, Iowa, will erect a planing mill.

Bonds have been voted for a municipal gas plant at Dexter, Iowa.

The city of Hillsboro, Ore., is planning to install a new sewer system.

The city of Kooskia, Ida., is planning to install a new sewer system.

The Kenmare Bottling Works, Kenmare, N. D., will erect a new plant.

The Jamestown (N. D.) Gas Company will shortly reconstruct its plant.

The city of Shelby, Mont., is planning to install a new waterworks system.

The city of Milwaukee, Ore., will soon be in the market for a rock crusher.

J. H. Atkinson of Richland, Iowa, is preparing to erect a canning factory.

M. Moriarity, Reardon, Wash., will build a 500-bbl. flour-milling plant at Pasco.

Ewing & Gibbs, Wenatchee, Wash., are planning to build a sash and door factory.

The city of Eugene, Ore., is planning to install a sewer system to cost about $28,000.

Fred Clark, of Rockwell City, Iowa, is planning to erect an ice-manufacturing plant.

G. F. Fritchie, Spokane, Wash., will build a new factory for the manufacture of paints.

Webster City, Iowa, is preparing to spend $50,000 for a new lighting and water plant.

John W. Seares Spokane, Wash., is planning to build a canning factory at Brandon, Ore.

F. J. Conneaux, Hidden inlet, Portland canal, Alaska, will build a new fish-canning plant.

The Aristo Engraving Company, Los Angeles, Cal., will build an addition to its plant.

The board of trustees, Bisbee, Ariz., will install a new pumping plant to cost about $4000.

The city of Glasgow, Mont., will make improvements in its sewer system to cost about $25,000.

C. J. Hamm, Medford, Ore., will build a pickle factory and vinegar works at Middleton, Ore.

The city of Sumas, Wash., will install a new sewer system. About $20,000 is estimated cost.

The Twogood Construction Company, of Pilot Mound, Iowa, will erect a cement-products plant.

J. L. Clark and B. A. Washburne, Springfield, Ore., are planning to erect a vegetable-canning factory.

The Shenandoah (Iowa) Artificial Light, Power, Ice and Heat Company will install an artificial ice plant.

The Broadway Lumber and Manufacturing Company, Spokane Wash., will build a new sash and door factory.

The American Lithia and Chemical Company, San Bernardino, Cal., has selected a site for a new factory.

The Welding & Independent Fisheries Company, Seattle, Wash., is planning to install new cold-storage plants.

The Delta Creamery Company, Imperial, Cal., will increase the capacity of its plant and install new machinery.

Robert and Charles Meara, Junction City, Ore., will build a factory for the manufacture of a patented cement block.

The Pacific American Fisheries, Bellingham, Wash., is planning to build a new salmon-canning plant in Alaska.

The Olympia Brewing Company, Olympia, Wash., will build a new plant at Salem, Ore. About $100,000 will be expended.

The Hawk Fish Company, Seattle, Wash., has commenced the erection of a new canning plant at Hawk Inlet, Alaska.

The Union Oil Company, Los Angeles, Cal., is planning to build a large oil refinery in the vicinity of Redondo Beach, Cal.

The city of Springfield, Ore., is planning for the erection of a distributing station for its proposed municipal lighting system.

The Los Angeles Mill and Lumber Company, Los Angeles, Cal., has taken out a permit to build an addition to its plant.

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L. S. Atkins, of Center, Tex., has been donated a site at Alto, Tex., on which electric-light and ice plant will be erected.

The city of North Yakima, Wash. (city engineer, Doolittle), is contemplating the installation of a sewerage disposal plant.

The Oregon Power Company, Eugene, Ore., is planning to make improvements in its power system at Albany, to cost $100,000.

The city council, Seattle, Wash., has authorized the board of public works to expend $125,000 for garbage disposal equipment.

The Citizens Water Company, San Jacinto, Cal., is planning to make extensive improvements in its system and new irrigation work.

R. A. Jones, Opportunity, Wash., is planning to install a 20-horsepower pumping engine in connection with irrigation work.

The Associated Oil Company, Los Angeles, Cal., will install an electric-lighting plant on its Pioneer Midway property near Bakersfield.

The Sacramento Valley Power Company, Chico, Cal., has obtained water rights on Deer creek, and is planning to erect a power plant.

The city of Kirkland, Wash., is contemplating the installation of a new waterworks system. Pumping equipment will be required.

The city of Portland, Ore., will make improvements in its water system to cost $500,000. Bonds for this sum have been issued.

The Lindenberger Packing Company, Inc., operating on Behm canal, southeastern Alaska, will build a new salmon-canning factory.

The Salt Lake Railroad is planning to install a new rock crusher at Las Vegas, Nev. Geo. Barrett is foreman of construction at this point.

Boydston Brothers, Boydston Heights Orchard, Porterville, Cal., will build a new fruit-packing plant. Modern equipment will be installed.

The Western Canada Power Company, Sumas, Wash., is planning to build a power plant in this vicinity. About $100,000 will be expended.

The Broadview Dairy Company, Spokane, Wash., is having plans prepared for a new plant. About $18,000 will be expended in new machinery.

The water commission, Wenatchee, Wash., will soon advertise for the purchase of pumping equipment, for its waterworks system, to cost about $5000.

The Gateway Gazette, Beaumont, Cal., will increase the capacity of its printing plant. A new building will be erected. New machinery will be installed.

The Mt. Hood Railway, Light and Power Company, Portland, Ore., has purchased property at South Milwaukee, Ore., and will build a new power station.

The Tee Harbor Packing Company, Tee Harbor, near Juneau, Alaska, will build a new fish-canning factory. R. E. Davis is head of this company.

The Bernhard Mattress Company, San Francisco, Cal., has purchased a site at York and Eighteenth streets, and will build a new factory for its specialty.

The Pierce county commissioners, Tacoma, Wash. (Torger Peterson, chairman), are planning to install a power plant for lighting the county buildings.

The Kenneth Gordon Preserving Company, Lewiston, Ida., is planning to build a fruit-preserving plant at Portland, Ore. Modern equipment will be installed.

Bids will be received up to May 4 by the construction quartermaster, Fort Mason, Cal., for new pump house and machinery to be erected at Fort Baker, Cal.

Power-plant equipment will be required in the new eight-story hotel to be erected at Portland, Ore., by V. Dessert. Preusse & Zittle, architects, Portland.

The Eagle Rock Water Company, Los Angeles, Cal., has been granted a franchise in the Eagle Rock district and is planning to install an electric-lighting system.

The Los Angeles Investment Company, Los Angeles, Cal., builders of homes, has taken out a permit to erect a new cabinet and mill-plant addition to its lumber plant.

The Rogue River Power Company, Grants Pass, Ore., will engage in extensive irrigation work in this section. A power plant and pumping plant will be installed.

The Siskiyou Electric Light and Power Company, Yreka, Cal., will build a new power plant on the Klamath river. About 20,000 horsepower is expected to be generated.

The Conservative Realty Company, San Jose, Cal., now building a large hotel, will shortly ask for bids for cold-storage plant equipment. Wm. Binder, architect, San Jose.

Power-plant equipment will be required in the new 10-story office building contemplated at San Francisco, Cal., by Mr. Sudden, of the lumber firm of Sudden & Christensen, San Francisco.

The Seldovia Salmon Company, Seldovia, Cook's inlet, Alaska, will build a new canning factory. Julius Redlesheimer and Benj. Moyses, Seattle, Wash., are at the head of this company.

Power-plant equipment will be required in the new 10-story office building to be erected at Portland, Ore., by Anton Huth, president of the Pacific Brewing and Malting Company. Estimated cost, $350,000.

Power-plant equipment will be required in the 12-story office building to be erected at Portland, Ore., by Robert Smith and Fred Stanley. About $300,000 will be expended. Owners are residents of Portland.

The collapse of a generator in the power house of the San Joaquin Light and Power Company, near Bakersfield, Cal., destroyed equipment to the extent of $25,000. Headquarters of company, Los Angeles.

The Oregon-Washington Corporation, Vancouver, Wash., has been granted a franchise for gas, waterworks and traction, and has agreed to expend $500,000 in improvements in this work in the immediate future.

C. D. Moore & Son, South Bend, Wash., operating a factory for the manufacture of logging tools, will move its plant to Kirkland, Wash. New buildings will immediately be erected and the former capacity increased.

John B. Hart, Seattle, Wash., is at the head of a project to erect a 10-story office building at Tacoma. About $300,000 is estimated cost. Power-plant equipment will be required. Russell & Babcock, architects, Tacoma.

F. C. Barnes Company (J. J. Reynolds), Portland, Ore., salmon packers, have leased a large building in the Marshfield district, and will equip it for a canning plant. New machinery will be installed; new cold-storage equipment will be added.

The Pacific Power and Light Company, Portland, Ore., has acquired the plants of the Hood River Power and Light Company, Hood River, and the Husom Power Company, White Salmon, Wash. The capacity of the latter plant will be increased; extensive improvements are planned. About $1,000,000 will be expended.

CANADA

Watrous, Sask., will equip a complete electric-light plant.

Kerrisdale, B. C., will install a $175,000 waterworks pumping plant.

Ridgetown, Ont., will install a $50,000 waterworks pumping system.

The Perfection Concrete Company is building a large factory at Winnipeg.

The Independent Tire Company will build a $100,000 factory at Peterboro, Ont.

The Finnish Publishing Company will equip a large new plant at Port Arthur, Ont.

The Shawinigan Lake Lumber Company will equip a $300,000 plant at Merritt, B. C.

The Berliner Gramophone Company is building a large addition to its factory in Montreal.

The Electric Power Company, of Peterboro, is making important extensions to its plant and system.

The Diamond Sawmills Company will equip an immense mill at Big Eddy, near Revelstoke, B. C.

Winnipeg is in the market for a horizontal turbine pump with a capacity of 2,500,000 gallons per day.

Eight thousand dollars worth of machinery, destroyed by fire in the Beck box factory, at London, Ont., will be replaced immediately.

A. C. Pyke, of Dartmouth, N. S., is head of a new company which will establish a power plant and operate an electric road there.

The board of control of the city of Toronto will buy six saddle-tank locomotives, 36-inch gage, two full circle swing traction steam shovels and a large quantity of cars and equipment.

MINING

The Sovereign mine, Sierra county, Cal., is contemplating the erection of a mill.

The Caladonia mine, Wardner, Idaho, is contemplating the erection of a concentrating plant.

The Richmond-Sitting Bull mine, Galena district, S. D., is planning to install new machinery.

The Steptoe Valley smelter, McGill, near Ely, Nev., is planning to install a modern slimes plant.

The Golden Slipper mine, near Hill City, S. D., is planning to make improvements in its stamp mill.

The Peterson lease, near Vault, Fairbanks district, Alaska, is contemplating the erection of a mill.

The Gold Coin mine, Gold Run district, Nev., will install a five-stamp mill and make other improvements.

The Cleopatra Arizona Mining and Milling Company, Tombstone district, Ariz., is contemplating the erection of a new mill.

Edward Beggs, operating in the La Paz mining district, near Yuma, Ariz., is planning to install a modern hydraulic plant on his properties.

The Bully Hill Copper Company, operating near Delamar, Shasta county, Cal., is planning to remodel its smelting plant. New equipment will be installed.

The Santa Maria Oilfields Company, Santa Maria fields, near Santa Barbara, Cal., has purchased holdings of the Palmer Annex Oil Company, and is planning to install new equipment.

BUSINESS ITEMS

The Standard Gauge Steel Company, of Beaver Falls, Penn., has opened a branch office in Philadelphia, which is located in the Pennsylvania building.

The New Departure Manufacturing Company, of Bristol, Conn., is organizing a western branch in Detroit, Mich. A complete stock of its bearings and other specialties will be maintained here.

Through an agreement entered into between the International Acheson Graphite Company and the Acheson Oildag Company, the first named company, on April 1, became general agents in the United States for the sale of the new lubricants, Oildag and Aquadag, products of the second-named company. This means that the trade will, in the future, be supplied with Oildag and Aquadag by the International Acheson Graphite Company, of Niagara Falls, N. Y.

TRADE CATALOGS

Tate, Jones & Co., Inc., Pittsburg, Penn. Pamphlet. Heat Treating of Steel. Illustrated, 40 pages, 4½x7½ inches.

The Bristol Company, Waterbury, Conn. Bulletin No. 131. Recording voltmeters. Illustrated, 44 pages, 8x10½ inches.

Victor Appliance Company, Watervliet, N. Y. Catalog No. 1. Vaco flexible coupling. Illustrated, 14 pages, 3½x6 inches, paper.

Central Autogenous Welding Company, 73 Union street, Worcester, Mass. Circular. Ball-bearing polishing machine. Illustrated.

Collins Axle Manufacturing Company, Frick building, Pittsburg, Penn. Catalog. Direct-drive axles for automobiles. Illustrated.

Lyon Metallic Manufacturing Company, Aurora, Ill. Catalog. Modern steel stock-room fixtures. Illustrated, 24 pages, 6x9 inches, paper.

The Bruce-Macbeth Engine Company, Cleveland, Ohio. Catalog. Vertical multi-cylinder gas engines. Illustrated, 32 pages, 7x10 inches, paper.

The Washburn Shops, Worcester Polytechnic Institute, Worcester, Mass. Catalog. Worcester drawing stands. Illustrated, 12 pages, 6x9 inches, paper.

General Electric Company, Schenectady, N. Y. Bulletin No. 4815. Motor drive for metal-working machinery. Illustrated, 25 pages, 8x10½ inches.

Rivett Lathe Manufacturing Company, Brighton, Boston, Mass. Catalog No. 27. Precision lathes and attachments, milling machines, grinders. Illustrated, 128 pages, 6x9 inches, paper.

Forthcoming Meetings

National Metal Trades Association, thirteenth annual convention, April 12-13, Hotel Astor, New York City. Robert Wuest, commissioner, New England building, Cleveland, Ohio.

Southern Hardware Jobbers Association and American Hardware Manufacturers Association; joint convention, San Antonio, Texas, St. Anthony hotel, April 26, 27 and 28, 1911.

National Machine Tool Builders' Association, spring meeting, May 18-19, 1911, Hotel Marlborough-Blenheim, Atlantic City. Chas. E. Hildreth, secretary, Worcester, Mass.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers, spring meeting, Pittsburg, Penn., May 30 to June 2, 1911. Secretary, C. W. Rice, 29 West 39th St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month. Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Tools, dies, jigs, etc., built to order. W. C. Munz, Erie, Penn.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

"Engineering Data." Thirty-five new sheets on April list. Box 677, Amer. Machinist.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Tools, jigs and fixtures designed; your pat. ronage solicited; satisfactory work guaranteed. G. S. S., 92 Spring St., Newport, R. I.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 900 G St., Washington, D. C. Write for Inventor's Handbook.

Tools, jigs and fixtures designed for rapid productions; send blueprints for estimates. W. A. J. & Co., 596 Hyde Park Ave., Hyde Park, Mass.

Wanted—Work for gear cutters, hand turrets, milling machines, etc.; fine work in quantities. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Case hardening on carbon and alloy steels; with our new furnaces we are able to take on a little more work at this time. Boston Gear Works, Norfolk Downs, Mass.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Tools, dies, jigs and light and medium weight machinery designed and built to order; duplicate parts, either machined or die cast. Precision Die Casting Co., 422 So. West St., Syracuse, N. Y.

Are you looking for an exclusive agent on your goods for New York, Brooklyn and Long Island? We are in our new building open to do business. Edwin B. Stimpson Company, 68-70 Franklin Ave., Brooklyn, N. Y.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

A representative of large Belgian and British firms in Russia wants to add to his line, American tools and labor saving devices; only exclusive agencies considered. Address Messrs. Maller & Yackewicz, Moscow, Russia.

Welding by oxy-acetylene process; special attention given to repairs of machinery and castings of all kinds; large experience in difficult experimental work; structural shapes welded together; write for particulars. Krajewski-Pesant Co., 54 Beard St., Brooklyn, N. Y.

We invite proposals for a quantity of steam engines about 1½" bore by 2½" stroke to operate at about 15 pounds pressure and 200 revolutions per minute; would prefer to buy from builders' patterns, if design meets our approval. The Bartholomew Co., Peoria, Ill.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraphic Company, Baltimore, Md.

Watervliet Arsenal, Watervliet, N. Y., April 1, 1911. Sealed proposals, in duplicate, subject to the conditions of the sale, will be received at this office until 10 o'clock a.m., May 1, 1911, for the purchase of condemned ordnance stores. Catalogs giving quantities, condition, etc., can be had on application to the Commanding Officer, Watervliet Arsenal, Watervliet, N. Y.

New York engineering sales agent, graduate mechanical engineer, Massachusetts Institute of Technology, wishes to represent manufacturer of engineering equipment, etc., requiring the service of a technically trained sales agent who could superintend the installation and demonstrate apparatus by an efficiency acceptance test on a trial unit; communication desired, with European patent right proprietors. Box 731, American Machinist.

Wanted—Competent man with $5000 to take third interest in a sawmill and water right in northern California; good plant, 10,000,000 feet to cut and plenty more timber in sight; good water power; economical production; good market; water right will develop 20,000 horsepower and will be very valuable in near future; experience preferred, but not necessary; $5000 a year net profit. Box 650, American Machinist.

Why not get more Russian business? (See American Machinist of November 17, 1910.) Young sharp mechanical engineer with world-wide experience in organizing and managing business, desires to represent a first class American concern in Russia; machinery or tool steel preferred; speaks Russian and six other languages; knows Russia and her ways; applicant has been very successful in opening new territories; is expert in tool steel; is able to give security. Write for detailed information or interview, "Russia." Am. Ma.

Representative; German manufacturing company, Europe's largest and leading concern in pneumatic tools, having developed these lines to a perfectness, exceeded by no other manufacturer in the world, and enabling it to meet every competition, is contemplating extending its sale to the United States, and solicits correspondence from American engineering or manufacturing concerns of first rank, having a large selling organization, for which the pneumatic tool line is adapted; a representative of the European company, will arrive in New York about the middle of April. Address Box "P. L.," American Machinist.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CALIFORNIA

Wanted—Foreman for machine shop doing general machine shop work in Los Angeles, Cal.; state age, experience, former employers, salary wanted and qualifications for such a position; man with western experience only desired. Box 709, American Machinist.

CANADA

Wanted—Mechanical draftsman for machine shop employing about 200 men, in a live Ontario town, doing principally jobbing work for mills, steamboats, railways, etc.; steady employment the year round for a capable and willing man; give full particulars, state salary expected and when ready to assume duties. Box 727, American Machinist.

ILLINOIS

Wanted—Draftsman; one familiar with multiple stage blowers preferred. Houston Manufacturing Co., Rockford, Ill.

MASSACHUSETTS

Wanted—Experienced man to take entire charge of gage department in large factory; must have executive ability; we want the best; no other need apply. Box B, Am. Ma.

Wanted—Designing draftsman with electrical experience, preferably with a technical education, for a permanent position with the General Electric Company, Lynn, Mass. Apply stating age, education, experience and salary expected by addressing Chief Draftsman, General Electric Co., Lynn, Mass.

NEW JERSEY

Wanted—Draftsmen, toolmakers and first class machinists. Address Saurer Motor Co., Plainfield, N. J.

Gear cutting foreman, with general experience; must know something about figures, and be familiar with spiral, worm and bevel gears; state age, experience and some idea of salary expected. Address "Gear Cutting," Box 690, American Machinist.

NEW YORK

Wanted—Young man with experience in tool steel tempering. Box 716, Am. Mach.

Wanted—A first class designer for special printing machinery; only those who can furnish the best of references need apply. Box 566, American Machinist.

Wanted—Man with training and experience in structural work, furnaces, brick work, piping, etc., for drafting room; first class man only; give full particulars, stating age and salary required, to Box 679, Am. Mach.

Wanted—First class hand screw machine foreman; job also includes two Brown & Sharpe, and one large size Gridley automatic; man must be resourceful and first class handler of help; good pay to right party. Address Box 730, American Machinist.

Wanted—Jones & Lamson operator to set up and take charge of bar and chucking lathes on a large variety of work; none but good competent men who have held a similar position need apply; give age, experience and salary. Box 689, American Machinist.

Wanted—A young man who can write good, understandable English without frills or attempts at "literathoor," and who has had shop experience; one who has successfully handled mechanical advertising copy preferred. Box 712, AMERICAN MACHINIST.

Wanted—Foreman for tin shop on high-grade automobile work; state age, experience, name, employers for the past five years, give salary expected and reason for making a change; all replies will be treated confidentially on request. Address "Tin Shop," AM. M.

Wanted—Assistant foreman with technical and practical knowledge of the carbonizing, hardening and treatment of steel; must be familiar with uptodate methods and capable of handling men; state age, experience and salary expected; all replies treated confidentially. Address "Carbonizing," AM. MACH.

Wanted—Superintendent with good executive ability and education; to have full charge of plant manufacturing high grade machine tools; must be competent to direct designing of new machine tools and special fixtures for accurately producing duplicate parts in quantities; state fully experience, education, age and salary. Box 726, AMERICAN MACHINIST.

Wanted—Foreman machinist, a steady, industrious man to take charge machine shop, making brass automobile parts; employ 20 machine hands and three toolmakers; man must be capable of estimating tool and labor cost from blueprints; in replying state experience and salary expected; a good opening for right man. Address "Central," Box 695, AMERICAN MACHINIST.

Wanted—Assistant foreman in factory manufacturing instruments of precision in quantities, by interchangeable methods; applicant must be sober, of good character, up to date, versed in modern system of manufacture and have served in a similar capacity before; give age, nationality, whether single or married, salary expected and references, which are strictly confidential; attractive and steady position for the right party. Box 713, AM. M.

Factory for manufacture of ball bearings desires immediately energetic and able young engineer to visit the American trade and assist the branch manager in New York technically; long experience in general machine building necessary; speak perfect German and English and must be able designer; offers, stating past experience, religious denomination, life and education and salary expected. Address to Rudolf Mosse, Stuttgart, Germany.

Wanted—Assistant foreman for grinding department on a line of high grade automobile work; successful applicant must be a man that has had a position of responsibility in that line, that understands the setting of piece rates and be uptodate on modern methods of grinding; no application will be considered that does not contain the following information: age, married or single, experience, firms employed by during the past six years, the position held with each firm, wages expected and when available; this is an exceptional opportunity for a good man; any reply will be treated confidentially on request. Address "Grinder Foreman," AM. M.

OHIO

Wanted—Horizontal boring bar and lathe hands; state age, experience and give reference. The Heisler Company, St. Marys, Ohio.

Wanted—Automatic screw machine operators on Cleveland and Gridley machines; men who have had experience on large work; no labor troubles; steady work the year around. The Timken Roller Bearing Co., Canton, Ohio.

Wanted—First class tool and jig designer for large automobile concern in Ohio; must be up to date on modern methods and come well recommended; address, stating particulars and wages expected in first letter. Box 703, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 693, AMERICAN MACHINIST.

Draftsmen—Several draftsmen on tools and automobile parts wanted by a firm in western Pennsylvania; state salary expected and when you can report. Box 667, AM. MACH.

Wanted—Young man thoroughly trained in uptodate machine shop practice to assist foreman in increasing production and inspecting work produced; man familiar with piece or premium methods of engine shops preferred. Address Drawer "E," Erie, Penn.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—A first class machinist and repair man as assistant to head machinist in paper mill; must be familiar with quick repair work on this or similar kind of work and capable of laying out work and handling 30 to 40 men; experienced on boiler and engine repairs essential; this is an excellent opportunity for a first class man; give experience, references and salary expected. Box 725, AMERICAN MACHINIST.

Wanted—Fifty tool designers; experienced competent men in the design of jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

WISCONSIN

Wanted—A good draftsman, experienced and well educated, preferably thoroughly familiar with all features of design upon cream separators; steady work and good prospects; give references, state experience and wages expected. Address P. O. Box 1590-A, Milwaukee, Wis.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Foreman toolmaker desires change; A-1 all-around man, good executive and estimator, capable of taking entire charge of the manufacture of novelties, etc. Box 729, AM. MA.

Steady position by a Swiss; technical mechanic graduate; first class toolmaker and designer on dies, tools and machines for production of interchangeable parts; novelty and brass goods; seven years factory experience, five in United States; systematic and of good character; able to supervise; Middle West preferred. Box 711, AMERICAN MACHINIST.

ILLINOIS

Works manager or superintendent desires position with a concern operating machine shops, foundries, etc.; thorough knowledge of and wide experience in modern methods of management. Box 700, AMER. MACHINIST.

MASSACHUSETTS

Practical mechanic, expert designer of tools and special machinery; extensive experience with executive ability, desires responsible position. Box 701, AMERICAN MACHINIST.

A blacksmith, with four years' previous experience as assistant foreman, wants position as foreman; is first class mechanic with some knowledge of drop work hardening, etc.; uptodate on figures and drawings; now employed in large machine forging department; will take working foreman's position; six to eight fires; compensation reasonable. Box 714, AMERICAN MACHINIST.

Superintendent or general foreman, American, 40 years old, wide experience handling men, and reliable, desires to correspond with a going concern who is in need of such a man; now holding position as general foreman, but is looking for a similar position paying not less than $1800 per year, and an opportunity for investment in the business; any location and any line of manufacturing will be considered. Box 675, AMER. MACHINIST.

MEXICO

A-1 machinist desires foreman position. Francis Regnault, Apartado 136 Bis, Mexico City, Mexico.

NEW JERSEY

Mechanical engineer, specialist in the design of printing machinery, at liberty after April 1. Box 704, AMERICAN MACHINIST.

Tool room and manufacturing foreman wishes to change; successful increasing production, decreasing manufacturing costs; go anywhere. Box 691, AMERICAN MACHINIST.

Position as chief draftsman or assistant superintendent by mechanical engineer; technical graduate; ten years' experience as mechanical and electrical designer; six years present position as chief draftsman; best of references. Box 707, AMERICAN MACHINIST.

NEW YORK

Mechanical conveyer, structural draftsman, reliable detailer, wants position. "Designer," AMERICAN MACHINIST.

A producer, twenty-five years' experience, open for superintendent or general foreman. Box 644, AMERICAN MACHINIST.

Draftsman (28), graduated mechanical engineer, experienced in designing cranes and elevators. Box 728, AMERICAN MACHINIST.

Draftsman, experienced detailer on automatic machine tools, would like position in New York or vicinity. Box 722, AM. MACH.

Draftsman, age 28, ambitious and reliable; technical education; five years drafting room and four years' experience as machinist. Box 724, AMERICAN MACHINIST.

Uptodate foreman desires change; wide experience on tools, jigs and general manufacture; good executive; first class references. Box 717, AMERICAN MACHINIST.

Mechanical draftsman, ten years' experience on special and automatic machine design, jigs, tools and fixtures, desires position with growing concern. Box 721, AMER. MACHINIST.

Young mechanical engineer, with five years' technical education, and several years draftsman and shop practice, wants position as draftsman. Box 720, AMERICAN MACHINIST.

I wish to correspond with a firm desiring the services of an uptodate mechanic to act as tool room foreman; thoroughly understands handling men. Box 708, AM. MACH.

Practical man having wide business and practical experience on machine tools, wants to hear from you regarding the position you need a competent man for. Box 733, AM. MA.

Young mechanical engineer (Swiss), with good technical education, seeks situation as draftsman and constructor; willing to go anywhere; speaks French, German and Italian. Box 723, AMERICAN MACHINIST.

Sales manager or purchasing agent, salesman having had eight years' practical experience, three years on road selling machine tools, good correspondent, wishes change; prefer West. Box 732, AMERICAN MACHINIST.

Production man, all-around mechanic, understand thoroughly use of planers, lathes, milling machines, gear cutters, etc.; able to instruct operators and increase results; at present employed; $1500 to $1800. Box 698, AMERICAN MACHINIST.

OHIO

Practical mechanic who can demonstrate in any department in the manufacture of automobiles, considerable experience on gears, wishes position as superintendent or chief inspector; at present employed. Box 715, AM. M.

PENNSYLVANIA

Wanted—Position by first class general blacksmith; western Pennsylvania or eastern Ohio preferred; no booze; references. "M. R. G.," AMERICAN MACHINIST.

Man at present employed as tool room foreman in high grade shop desires position in similar capacity, or as foreman of machine shop; references. Box 710, AMER. MACH.

Accountant, factory and cost; good executive; specialty, applying Hollerith tabulating machines on sales analyses, costs, stock inventories, etc.; practical shop man; age 32. "Producer," AMERICAN MACHINIST.

WISCONSIN

Experienced, all-around mechanic, successful in charge of manufacturing and general repairs; recommended for efficiency and low cost of production; free to take position July 1; Oregon country town preferred. Address "R," AMERICAN MACHINIST.

Mechanical engineer (draftsman), 29 years, graduate of German technical university, four to five years' shop and designing experience, one year in the United States, special experience in shop equipments and tool drafting, desires change; will go anywhere, West or Middle West preferred. Box 718, AM. MACH.

FOR SALE

One 250-horsepower Hoppes live steam purifier and heater. Box 719, AMER. MACHINIST.

For Sale—Small iron planer, Wilkinson make; here's a bargain. The Emporium, Ft. Wayne, Ind.

Second-hand steam hammer for sale; 6-ton double frame hammer in good condition, which was replaced by a high speed forging press; immediate delivery. United Engineering & Foundry Co., Pittsburg, Pa.

Manufacturing business; outright or part; dies, presses and special machinery; established trade with best concerns in the United States; reason sickness. Box X-40, AMERICAN MACHINIST, 150 Michigan Ave., Chicago.

Foundry and machine shop for sale, between New York and Philadelphia, with railroad siding; cheap coal; good labor conditions; greatest bargain ever offered. Nicholson & Co., Sole Agents, 150 Broadway, New York, factory brokers.

Talks With Our Readers

By The Sales Manager

A letter came in a couple of weeks ago from a reader, making a bitter complaint against one of our advertisers.

He stated that he had sent this advertiser an order accompanied by check, but nothing whatever had been heard from him.

We immediately wrote this advertiser for an explanation, stating that only reliable concerns could advertise in the AMERICAN MACHINIST—

That our readers knew this; had faith in the selling as well as editorial sections—

And that, if we could help it, we would not permit anything to disturb this confidence.

The advertiser replied promptly that it was a clerical error in not acknowledging the order—

That the reason why shipment had not been made was that none of the goods were in stock; that a lot was being put through, and shipment would be made in a day or two.

This particular buyer is happy now, although for a time he was sore on advertising, and everybody connected with it.

We were glad to have had the opportunity to straighten it out.

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Of course, it's too big a job for us to settle or arbitrate the little business differences of buyers and sellers in the machine-making field.

But whenever you know, or even have a sneaking notion, that any concern advertising in the AMERICAN MACHINIST is unreliable, or does not intend to do business on the square-deal basis, we want you to tell us.

You will be doing a favor to yourself and the other buyers in the machine-making field.

You will be doing a favor to us.

Unreliable and false advertising has no place in the AMERICAN MACHINIST—it is shut out.

* * * *

Only reliable products can be continuously advertised.